

Radio Control CAR ACTION

THE WORLD'S LEADING R/C CAR MAGAZINE

May 1998

FIRST TEST
TRAXXAS
4-TEC

pg.84



Mod
Clods

WHICH
IS THE
MAXIMUM
MONSTER?

Bennett Clod-A-Leaver vs. ESP Clodzilla

FIRST LOOK!
MAXTEC
Shockwave



NOVAK
PIT WIZARD
TUNE YOUR ESC
TO FIT YOUR
DRIVING STYLE

TOP 10
YOUR PICKS FOR '98

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TIRES, CHARGERS,
MOTORS, DRIVERS,
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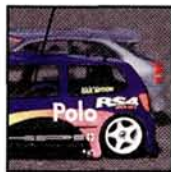
215 Chris's Back Lot

BY CHRIS CHIANELLI

ON THE COVER: ESP Clodzilla and Bennett Clod-A-Leaver Clod Buster conversions caught in the lens during hill-climbing competition; top—Traxxas enters the sedan racing scene with its new 4-Tec; bottom—Maxtec's new Shockwave modified motor. (All photos by Walter Sidas.)

Scaling down a legend

Minicar racing has been catapulted to a new level of performance with the release of HPI's new **RS4 Mini** 4WD electric sedan. At a recent Hobby Shack parking-lot racing event, 30 RS4 Mini drivers filled three complete heats of minicars. With stock motors, these little land missiles posted lap times that were as fast as those of the 4WD stock touring cars. This shouldn't come as a surprise, though; the RS4 Mini has many of the RS4 Sport's hot racing features, and because of its smaller size, its weight is considerably lower. Assistant editor Greg Vogel has been thrashing on his Mini for weeks, and now he reveals the results. Be sure not to miss our "Thrash Test" of the RS4 Mini right here in this issue.



Tamiya's **Clod Buster** is still considered top dog when it comes to ground-stomping, car-crushing, hill-climbing, 4WD monster-truck action. Over the years, ESP Hobby Mfg. and Bennett Racing Equipment have produced race-quality chassis components for this popular truck. Which truck takes the cake in the performance department?—the ESP Clod or the Bennett Clod? See our giant "Mod-Clod Shootout."

Novak's **Pit Wizard** hand-held programmer makes programming the software in that company's Cyclone and Atom ESCs amazingly simple, and the performance results can be an eye-opener. We've spent weeks testing this remarkable gear, and in this issue, we reveal our findings.

Parking-lot racing is certain to become even more popular now that Traxxas has introduced its new **4-Tec** 4WD touring car. This new parking-lot racer has all the go-fast features racers demand, and it carries a price tag that will undoubtedly attract newcomers to the hobby. And it's available RTR with radio gear installed. Don't miss the first test drive of this hot new vehicle, recounted right here in this issue.

See also our "1998 Top Ten Readers' Choice Awards," in which you voted on your favorite radio, motor, engine, ESC, batteries, charger, body, tires and drivers, as well as your favorite 2WD and FWD buggy, truck, touring car and on-road car. Don't miss your picks!

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Senior West Coast Editor

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WRITE TO US! We welcome your photos, drawings, comments and suggestions. Letters should be addressed to "Letters," Air Age Inc., *Radio Control Car Action*, 100 East Ridge, Ridgefield, CT 06877-4606. Letters may be edited for clarity and brevity, and each must include a full name and address or telephone number so that the identity of the sender can be verified. We regret that, owing to the tremendous numbers of letters we receive, we can't respond to every one.

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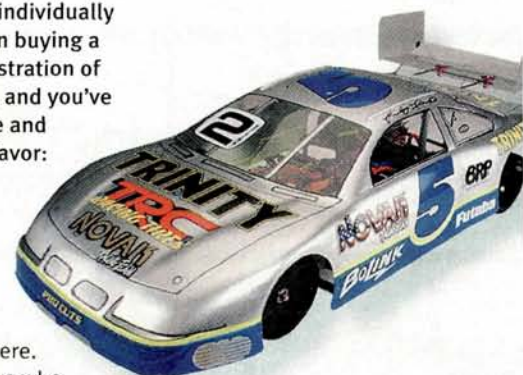
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take all the doo-dah day to get to those cars; their drivers are racing just as hard as the fast guys.
6. Next time you step on my car and snap the shock tower, maybe you could apologize.

I'll be out there watching you.

Call me

RACER X



Feed Your Mind

I just want to thank the whole staff involved with the magazine for the in-depth look at oval racing and the pros' setups. I really enjoyed the Kirby Hand championship setup page and the Winterfest race coverage in the March issue. Thanks again, and I hope there will be more emphasis on oval racing in future issues, as well. I am always looking to learn more. [email]
MATT KENNEDY

Hold tight Matt, there's plenty more oval action on the way. And drag racing, on-road, 1/8 scale, mini cars, monster trucks

—Pete

Kyosho. What platform could I use to put all the parts onto?

HEATH KRUG

Coluse, CA

Heath, your plan to build a car from parts poses a problem (and seems to be a tongue-twister). Each part is specifically designed for an individual car and is not intended for a universal fit. If you hand-fit the mismatched parts, you might be able to produce a working car, but it is doubtful that your Frankenbuggy would work well. The various parts of the cars you mentioned are designed to work together, and a good car is more than the sum of its parts.

Another point to consider is this: buying the parts individually will cost you more than buying a kit. Add to that the frustration of making them all work, and you've got a big waste of time and money. Do yourself a favor: buy a kit!

—Greg

Marshal!

Hey, guys. This is an open letter to all the corner marshals out there.

1. Why is it that the guys who are the most intolerant of honest marshaling errors when they're on the stand are also the worst corner marshals when it's their turn? Marshal unto others as they would marshal unto you.
2. If you can't get to my car quickly because of a bigger pileup elsewhere or because my car is far from you, fine. But could you please toss it over the board into the next turn so I can get a little time back? Thank you.
3. If you weigh 300 pounds and have emphysema, do us all a favor and marshal that big sweeper with the tall berm—you know, the spot where no one ever crashes? Stay away from the triples, we'll both be a lot happier.
4. Please, please, please put crashed cars back on the track in the order they crashed in. Why does the klutz who rams into the pileup last get plunked back on the track as the race leader?
5. The guys in fourth, fifth and sixth deserve the same marshaling attention as the leaders. Don't

a single-action or a dual-action brush. Single action allows you to control the airflow only, while a dual-action unit will control both air- and paint-flow. As for thinning the paint and how many psi to spray at, it's all trial and error. I spray between 20 and 30 psi and use some paints straight from the jar, while others are thinned down to the consistency of water. To make the patterns, use masking tape or liquid mask. With a marker, draw a design on the outside of the body and mask the inside, then cut out the pattern using a hobby knife. The marker can be removed with rubbing alcohol. Practice on a soda bottle; spray it in a well-ventilated area and always wear a filter mask.

—Greg

Learn to Earn

Hey, Pete! Let me start by saying that you guys put out an excellent magazine. There are always excellent and informative articles that I often refer back to. Let's get down to business. I'd like to say something to "Faithful Friend" from the December *R/C Car Action* "Letters" section. I'm 12 years old, and I have managed to earn enough money over the past year to get into this awesome hobby. I don't have the best equipment, but it's enough to race, and that's good enough for me. And I didn't ask anybody for the money, darn it! I baby-sat four-year-olds for that money, so I can truthfully say it is possible to earn \$250 by yourself.

ANDREW WIETSTOCK

Mission Viejo, CA

Way to go, Andrew. I'm willing to bet you've got one of the best maintained cars at the track; when you earn the dough yourself, you really appreciate what you've got. With your work ethic and smarts, you'll go far in life. Keep it up.

—Pete

It's Alive!

After reading numerous articles on 1/8-scale gas cars, I would like to own one myself. However, I would like to build one from parts of cars such as an OFNA or



Welcome Back

Years ago, my two best friends and I were heavy into R/C; boats, planes, cars, helis, we had it all! At 16, my focus drifted to girls, stereo gear, then college and now a new baby boy.

But recently, I was looking at the magazines in a local store when BOOM-BAM, there it was, the March issue of *Radio Control Car Action*. I took it home and wow, was I surprised to see how far R/C technology has come! I remember the Associated RC10 as the buggy to beat, and I always wanted one, but the new RC10B3 just blew me away! I have since rejoined the hobby with a new B3 Sport, and I've been having a great time racing. Your magazine is the R/C industry's best resource, and the baddest, most kick-butt book on the newsstand! DAMON CONVERSE
Fremont, MI

Body Art

After looking through your magazine, I was inspired to go out and buy an airbrush so I could take a crack at painting. But then I stopped dead in my tracks. I don't have the slightest idea which airbrush to buy; I don't know how many psi to spray at, and I don't know how to thin the paint or make the patterns.

C. ADAM WILLIAMS

Nashville, TN

Adam, many hobby and art supply stores carry airbrushes and accessories. Find a brand that fits comfortably in your hand. Then you will have to choose between



My interpreter,
Mariko.

Tokyo Nitro



It's Kyosho World Cup time again! It appears that ubiquitous event can pop up just about anywhere in the world. This time, the Nostalgic Series nitro cloud formed at the "Big Site" in Tokyo, Japan. Once again, we're talkin' evenly matched racing with awesome Ferrari, Ford GT-40 Cobra and Porsche bodies. I've said it before: this is definitely my kind of racing.

And wait till you see Tokyo!—the ultra-interesting city that mixes the modern age and antiquity. Mr. Data of "Star Trek" or Lord Toranaga from "Shogun" would be equally at home in this city of intrigue. And the girls! (somebody shoot me, please). Did you think I'd forget the girls and let you guys down? ... I DON'T THINK SO!!

But wait! There's more! Broken steering knuckle notwithstanding, yours truly battled it out for 45 minutes in the Nitro Mini Media Race with 14 other mag editors from around the world to save face for God, country and *Car Action!* Don't miss it.



Nitro-mini media
lineup.



BY CHRIS CHIANELLI



for the guys who must have the best

For you "cost is not a factor" guys who build those showstopping, monster truck machines: take a look at these. Hangar 9 Super Links are CNC-machined from aluminum and fitted with precision sub-miniature ball bearings that provide silky smooth, precise operation. These links supply the optimum in strong, no-slop precision control and offer extremely smooth action for lower servo drain and longer battery life. They're available for 2-56 and 4-40 threaded pushrods, and 2mm mounting hardware is included. For more information, contact Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 352-1958; fax (217) 352-0355; website: www.horizon-hobby.com.

Class 8 XX-4

What a refreshing departure from those non-descript, look-alike buggy bodies! Team Losi creates a realistic new look for the 4WD XX-4 off-road machine with this Class 8 truck body. This closed-course-type body is modeled after Scott Taylor's two-time S.O.D.A. series championship-winning Ford. I have to say, the finished body is an outrageous-looking racer that replicates the factory race trucks we see on national TV. Way to go, Losi guys; I love it! One look at this thing and I want to do some fender-to-fender racing myself. A special detail/logo sticker sheet and pre-cut window masks are included. For more information, contact Team Losi, 13848 Magnolia, Chino, CA 91710; (909) 465-9400; fax (909) 590-1496; website: www.teamlosi.com.



Kings of Speed

During the final rounds of the '98 IEDA/Big Daddy Nationals, Chris Collins of Costa Mesa, CA, accomplished two goals: he took the win light in the Top Fuel Dragster Class finale and broke his own IEDA all-time speed time record. Shown here after winning the finals, Collins shows off his G-Force-powered electric slingshot to the "Swamp Rat" himself—full-scale Top Fuel and Funny Car legend, "Big Daddy" Don Garlits.

Along with the rest of the crowd, Daddy Don witnessed Collins' record-snapping final pass, which, along with his earlier qualifying and elimination rounds, claimed the new record of 1.64 seconds at over 83mph. This broke his '97 Worlds run of 1.68 seconds for the 132-foot-long drag strip. That's one fast DC-powered, R/C rail, to be sure! Look for a full race report in *R/C Car Action* soon.

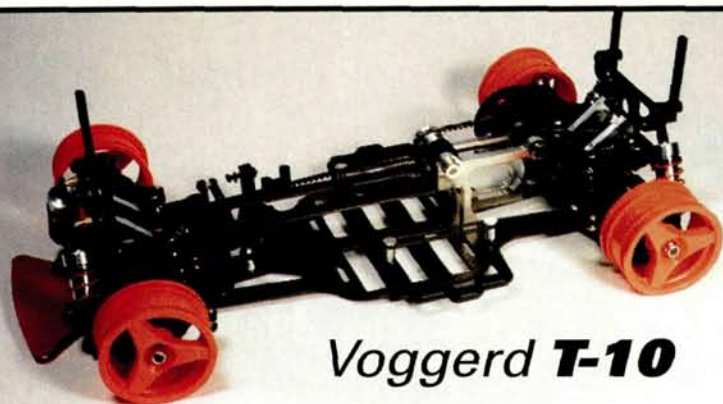
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Voggerd T-10

Tech Racing's Voggerd T-10 4WD touring sedan could be called a "tuners' car" because it offers a multitude of chassis adjustments. *Caster, camber and toe angle can be adjusted on both ends, as can rear bump-steer (toe-in angle decreases as the suspension is compressed), if your car needs help with corner-exit stability.*

The first version also boasted some rather revolutionary features such as suspension arms that pivot on pillow balls instead of hinge pins and a triple belt-drive system with ball diffs that are centered in the gearboxes instead of offset like those on most other 4WD touring cars. These features make the T-10 extremely sensitive to chassis adjustments, and this in turn helps drivers become better mechanics.

Tech Racing has now introduced a "racing special" version—appropriately called the "Voggerd T-10 RS"—that includes all of the T-10's hot features plus a whole lot more. The RS gives racers full ball bearings, universal dogbones, new upgraded shocks with tuned springs, one-way front diff, one-way center layshaft and graphite shock towers, and its graphite chassis allows the use of stick- or saddle-pack batteries. These are just a few of the RS's hot new features. No prices or part numbers were available at press time, but feel free to give GTP California (Tech Racing's U.S. distributor) a call for more information at (714) 756-1227.



Breathe easy; breathe clean

Judging from some of the letters I get, air filtration is a subject I definitely need to address in my "Piston Power" column. Anyway, here's a shot of the air-filter lineup from Motor Saver. These three-stage filters come in 1/8-scale and 1/10-scale sizes for both on-road and off-road vehicles. For optimum protection against superfine dirt and dust, use the optional, oiled, pre-filter inserts. On-road filters can be set up and tuned with or without a pre-filter—depending on track conditions—and the off-road filters have an 80-percent-airflow cap for smoother idle and acceleration.



All Motor Saver filters feature a synthetic fiber screen that the manufacturer claims is "micron-tuned" for instant throttle response. For more information, contact Motor Saver Filters, 24282 McCoy Rd., Lake Forest, CA 92630; (714) 455-0201; fax (714) 445-0249.

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- 9218 Opal, (10 Triple)
- 9219 Platinum, (13 Triple)



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Kyosho **Subaru Impreza**

Thought you guys might like a look at Kyosho's new 1/8-scale Impreza body for the Super 8 chassis.



More for the "must have" list!

Trinity just released some exciting new parts for Losi's XX and XX4 series vehicles as well as a hot new motor plate for their own Switchblade machines.

1. First is a hot—well, cool actually—motor mount for the XX4 and Street Weapon. This finned, thicker than stock piece gives the motor more heat-dissipating mass for cooler running. That means more torque and greater efficiency, so you can expect to see more than a few of these blue cookies in the pits.

2. Double-X 'CR' and XXT 'CR' owners, this is for you; the new "winged" transmission brace supports the buttresses for the rear shock tower to make your machine super-bulletproof. A flex-free tranny area improves gear mesh, too, and it looks cool—can't forget that!

3. For buggy pilots, Trinity's new wide front hubs offer another tuning option for the XX 'CR.' These hubs are direct replacements for stock, but the thicker hex gives the front wheels greater offset. Extra-long mounting screws are included.

4. If you run a Switchblade in the stock class, you probably already have a Midnight 2 bolted into the rear pod. Trinity's new motor plate takes full advantage of the motor's flat-sided design and lowers the motor to the absolute minimum. You can see just how low it is by checking out the lower motor-mounting slot. There's just a thin sliver of aluminum left under there!

New Schumacher hop-ups to make your SST truly SuperSonic!

Schumacher's SST touring car can heat up a racetrack straight out of the box, but you can always use some extra purple stuff! The new three-piece transmission housing (part no. U2034) is very light, yet it's stiffer than stock, so it offers superior power transfer. It also provides more motor-coolin' aluminum to prevent those hot mods from overheating.

Also new for the SST are these trick alloy microshocks that include six pairs of tuning springs (U2039). These mini-boingers will trim weight and they're super-smooth. They're also purple, which independent testing has proven to be the fastest color (really, it's true).

Schumacher has lots more new stuff in the pipeline, so watch this space!



"Readers' Rides" is our way of recognizing the unique, innovative—and sometimes bizarre!—vehicles that our readers have created. Send us a sharp, uncluttered, well-exposed color photo of your car or truck (no Polaroids, please!), along with a brief description, to Readers' Rides, *R/C Car Action*, 100 East Ridge, Ridgefield, CT 06877-4606. If we choose to feature your creation, you'll receive a 6-month subscription to *R/C Car Action*, or an extension of your existing subscription. You'll also be eligible for the eighth annual "Readers' Rides of the Year Contest" in the fall of 1998. The winner will be awarded \$500 and an assortment of electronic R/C equipment furnished by Novak Electronics Inc. Our second and third choices will also receive an assortment of Novak electronic R/C equipment. In case we need to contact you, write your address and phone number on your letter and on the back of every photo you send. Good luck!

Too Much Free Time

What do you do in your free time? Hiram D. Ortiz likes to paint bodies for his Kyosho TF-2. This is just one of the many he designed for his on-road ride. The chassis

incorporates a full set of ball bearings, HPI rims and Pro-Line tires. For the electronics, Hiram uses a Futaba 2PC radio, Novak Cyclone ESC, Trinity Speed Gems Diamond 12-turn motor and 1700mAh Sanyo battery.



High-Riding Hummer

Cole Zakem recently received a gift that has kept on giving: a Tamiya Hummer. Cole put it together immediately and custom-painted the body by hand for a "Desert Storm" look. But he wasn't totally satisfied with the truck's appearance, so he gathered up a few extra parts and lifted the body, then mounted truck tires and chrome rims. A Futaba radio system, Dynamite ESC and 13-turn Reedy Ultra motor maneuver the truck through any terrain.



First Attempt

T.R. Stephan has had his Associated T2 for just two years. It is his first R/C vehicle, and the excellent-looking body shows off his first attempt to paint with spray cans. Nice job! Inside the truck are a Tekin Rebel speed control, Motor Man stock motor, 1700mAh Ex-Tech battery, MIP CVDs, ball-bearing steering, titanium tie rods and an Airtronics XL2P radio system for control.

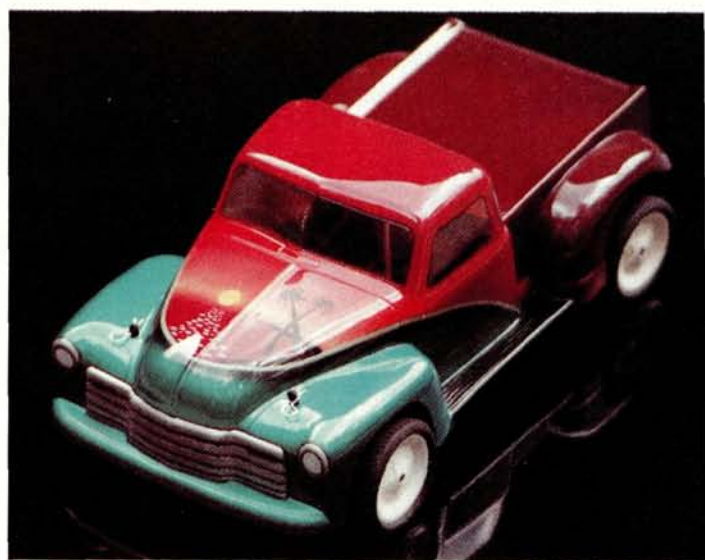
Mighty Miata

David Weir of Wauswatosa, WI, sent this picture of his stunning Tamiya Mazda Miata. David carefully cut the hard top off and added an HPI interior that was intended for the Z-3 roadster. Adding to the visual effects are full instrumentation, functional roll bar and Tamiya 4-spoke aluminum rims. A full set of bearings, aluminum steering system, ball differential, aluminum dampers and other mods were made to the chassis. David enjoys attending events such as Tamiya's TCS series, and he actually races this concours winner.



Chevy Cougar

Would you believe there's a Schumacher Cougar beneath this body shell? Terry Dunn reconfigured his Cougar to be a mid-motor car, then did a little "creative bending" to fit the front tires under the Parma Chevy truck body. He chose the Chevy body because it was the only one that came close to fitting. After he had installed the body, Terry went to town with the paint (or maybe "to the beach" would be more appropriate).



Drag Team

Jim, Kim, Shaun and Tiffany Dunlap of Portland, OR, sent us this photo of their custom-built and -painted drag racers. The Wheel Stander in the back is a '34 sedan delivery that incorporates a rear wheelie bar. This outrageous-looking ride really pleases the crowd with wheel stands of more than 195 feet! One of the funny cars is driven by Shaun, who put down a 35.3mph run in the stock class at a recent race. Kim drives the other car in the modified class and at the same event put down a 53.78mph run (and also found out the car goes 27.6mph on its lid!). Finally, Jim's dragster puts down 57mph runs in the unlimited class.



Too Nice to Run

Doug Smith of Oakville, Ontario, Canada, is another person hooked on custom Clod Busters. His project started 11 years ago with the purchase of his truck, and since then, he has been slowly adding aftermarket items and manufacturing custom parts. To date, Doug has added: chrome wheels, stainless-steel bearings, lower bumpers and suspension lift kit from ESP; two Novak 610 HRV speed controls; and two Trinity Speedworks Monster Mash motors. Finishing off the truck are a couple of chrome accessories from the Bullhead, a custom light bar with RAM roll-bar lights and Tamiya headlights in the grill. Doug explains his truck is ... "almost too nice to run—almost."



Superb Supra

John Duenas spent a lot of time on making his Tamiya Blitz Supra look as real as possible. John upgraded the chassis with Kose aluminum suspension arms and an onboard antenna, then he bolted in an HPI graphite chassis and added an HPI lowering kit to the front and rear. John uses a Futaba Magnum Junior radio to control the car's Tekin G12 speed control and Trinity Ex Mod motor. From the two photos, you can see that this car looks good at any angle.



Radio Control Car Action will give a one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Pit Tips." Send a rough sketch to Jim Newman, c/o Radio Control Car Action, 100 East Ridge, Ridgefield, CT 06877-4606. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. We're unable to publish many good tips because we don't have the sender's name and address. Please note: because of the number of ideas we receive, we can neither acknowledge every one, nor can we return unused material.

Pin Tip

Ryan uses ordinary safety pins instead of regular body clips. He finds that they just do not come off unless deliberately removed.

RYAN INGE, Chesterfield, VA

XX4 Taping Session

Before installing the XX4 motor clamp, press a piece of electrician's tape over the edge of the motor plate as shown. When the clamp is tightened, the tape will prevent the plate from shifting and knocking the pinion out of mesh after a hard landing.

PAUL GROOMS, Coal Valley, IL

The Thin Glue Line

When gluing your tires to the wheel rims, put the adhesive on the edges of the rims. This will hold the tires nicely, but when you want to remove the tires you need only press on the sides of the tires to break the glue line at the X.

ANDREA BASSO, Rome, Italy

Lube-a-Pen

Make this simple lubricant pump from an empty ballpoint pen body (a). Force a plug of sponge foam (b) into the bottom of the tube, secure it with a wrap of adhesive tape and seal the vent hole (c) with tape. Put a small amount of speed-control lubricant into the tube, insert a dowel plunger (d) and gently press on it to force the lube into the foam "brush." Apply the lube sparingly to the contacts of the controller, then place a pen cap over the brush for storage.

MIKEL ANDERSON, Sherwood Park, Alberta, Canada

Motorized Allen

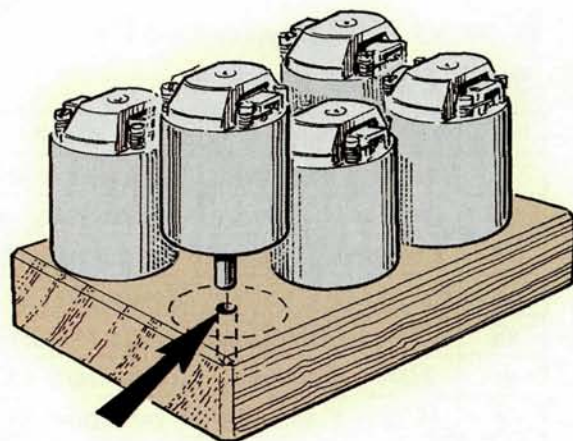
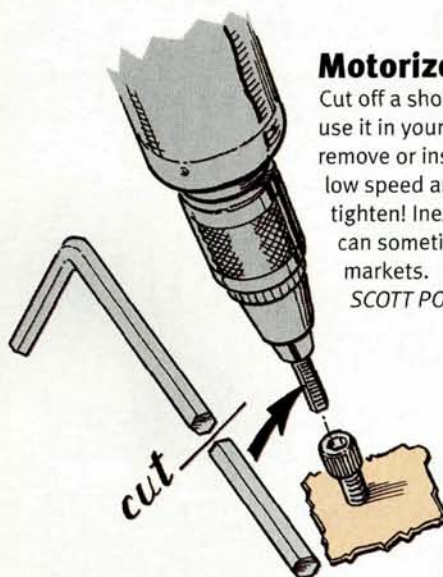
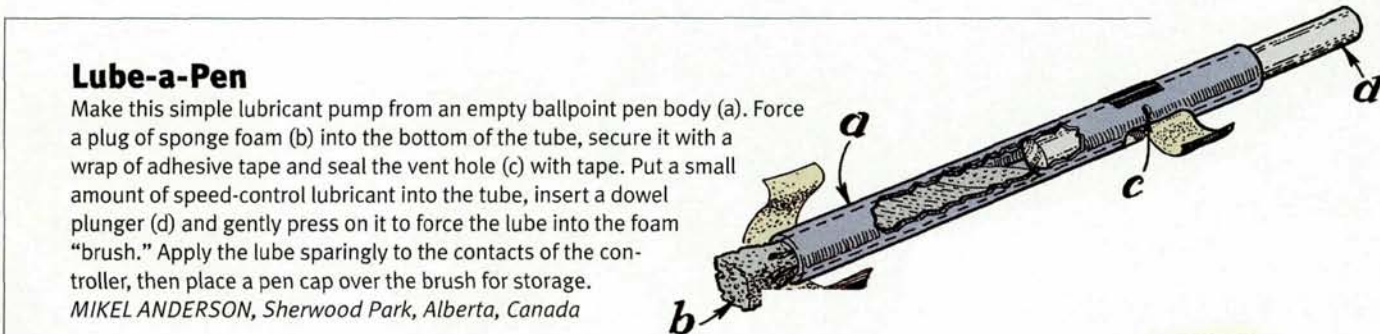
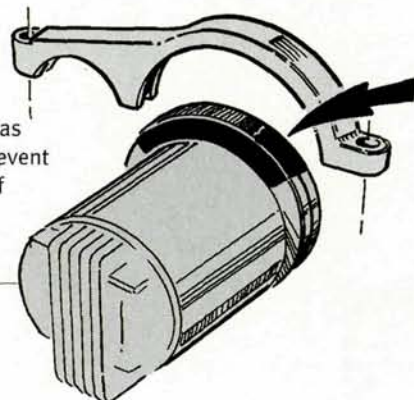
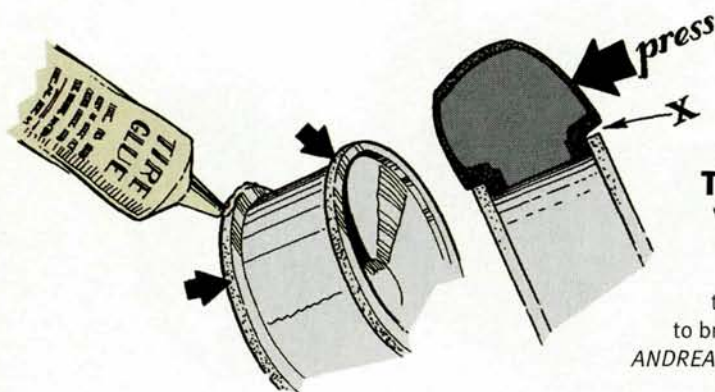
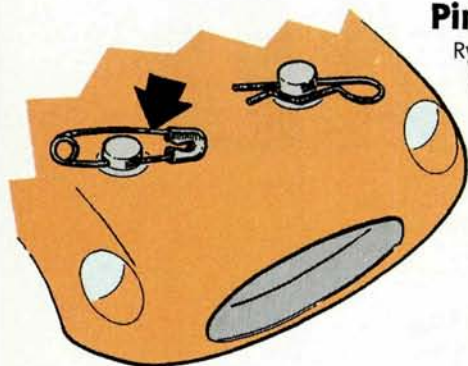
Cut off a short length of Allen key and use it in your variable-speed drill to remove or insert all those screws. Use low speed and be careful not to overtighten! Inexpensive Allen-key sets can sometimes be found at flea markets.

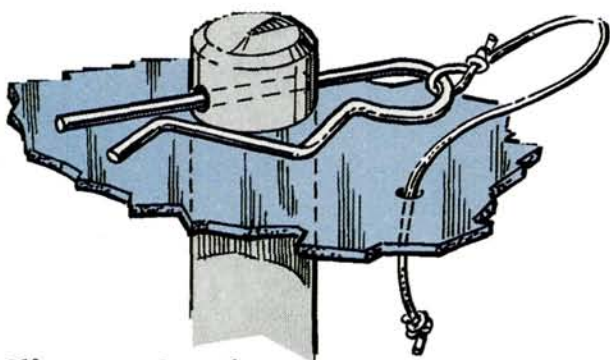
SCOTT POWELL, Aurora, CO

Hole in One

In a suitable block of wood, drill holes just big enough to hold your motor shafts. You'll then be able to stand your motors on the bench with no danger of them rolling off.

MICHAEL PLUMMER, Nowata, OK





Clips on a Leash

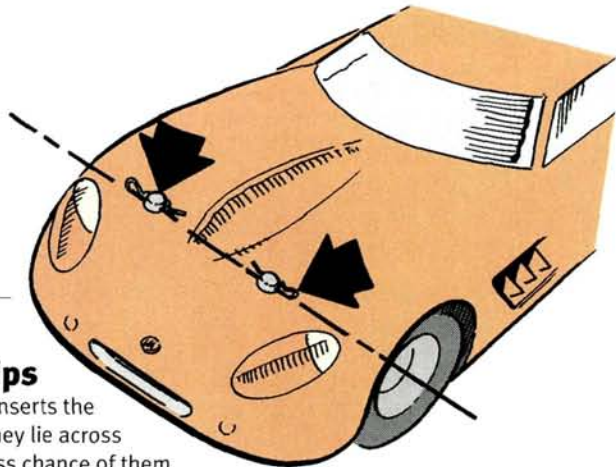
Drill a small hole close to each body clip. Fasten a piece of Dacron cord or nylon monofilament fishing line to each clip, pass it through the hole, then make a large knot underneath the body shell. Secure the knots with a drop of CA. Now you will never lose another clip.

JONATHAN STRIGHT, Goderich, Ontario, Canada

Sideways Clips

Tim finds that if he inserts the body clips so that they lie across the body, there is less chance of them jumping out in a head-on impact.

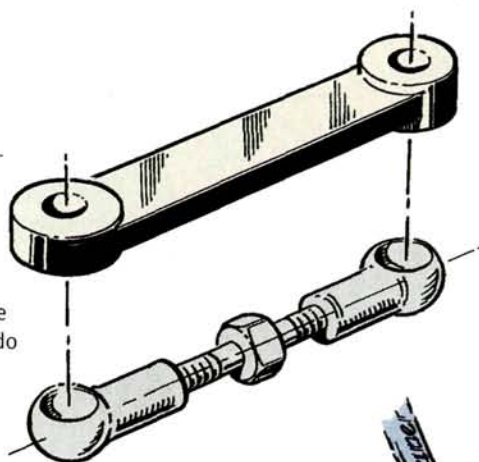
TIM AVARA, Elkridge, MD



A Better Link

You can remove the simple plastic suspension links from your Stampede and use the adjustable rods from the Nitro Stampede instead. Purchase the necessary front and rear rod parts, then do a straight swap, making sure the center-to-center distances are properly adjusted and matched.

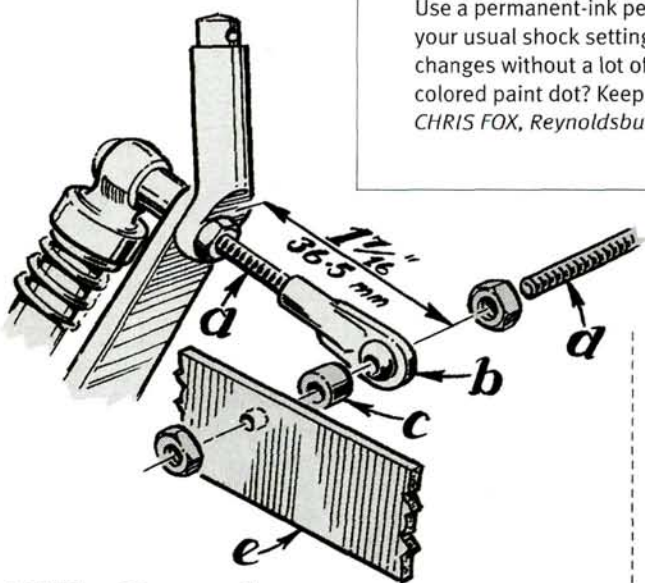
BRIAN FISHER, Fishers, IN



On your Marks

Use a permanent-ink pen or scratch a line on the shock bodies to show your usual shock settings. The marks allow you to make speedy changes without a lot of measuring. Why not code each line with a colored paint dot? Keep a note of the coded dots for future reference.

CHRIS FOX, Reynoldsburg, OH



Stiffer Stampede

Brace the front shock tower back to the chassis with a short piece of 4-40 threaded rod (a), a ball link (b), and an 1/8-inch-wide (3mm) tube spacer (c). Attach the parts to each side of the car as shown, then pass a long threaded rod (d) across the car and through the sides of the chassis (e). Secure the rod with nuts at each end. You can make a similar modification to the rear shock towers, too.

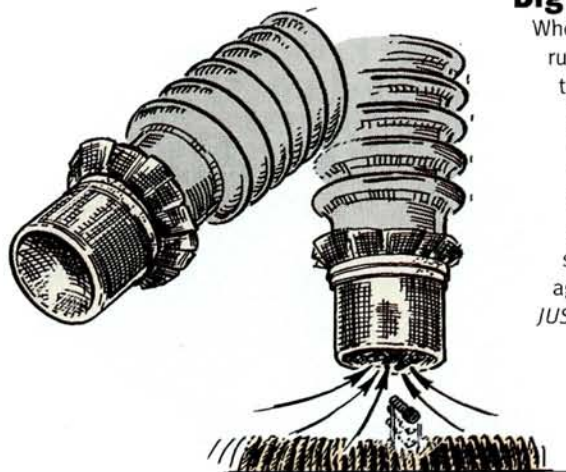
BARI MUSAWWIR, Cleveland Heights, OH



Big Sucker

When you lose a small part in a rug, simply use a rubber band to secure a piece of nylon stocking over the end of a vacuum cleaner hose, then pass it across the area where the part was dropped. The vacuum will suck up the part, and trap it against the nylon mesh.

JUSTIN CLARK, Lake Mary, FL



If you have a technical problem that your hobby shop or racing friends can't resolve, give us a shout at *Radio Control Car Action*, and we'll see if we can chase down an answer for you. Questions should be of a technical nature and should be addressed to *Troubleshooting, Radio Control Car Action*, 100 East Ridge, Ridgefield, CT 06877-4606. We regret that, owing to the tremendous number of letters we receive, we can't respond to every one.



Get the Drift

I have an Associated RC-10DS, and I have a great time driving it around in my driveway. My problem is I can't get it to drift around the corners. I think there's too much weight in the back. Any suggestions?

ADAM KUHN
Madison, WI

Four-wheel drift occurs when the car slides around corners with all four wheels at the edge of their traction limits. That's pretty hard to accomplish with a 2WD car, so I can understand why you've been frustrated! Weight distribution has less to do with it than you might think, however. A 4WD car can slide through corners more easily because all four wheels are driven at the same speed; if the front and rear wheels break traction on a consistent surface, the 4WD system will keep them slipping at the same rate, so the car drifts rather than spinning out.

With a 2WD system, the undriven front wheels don't want to slide with the rears, so the car loops out. Two-wheel-drive cars can be made to drift with judicious countersteering to keep the car sideways (just watch the dirt-oval guys in action), but this takes quite a bit of skill and a precise car setup.

I suggest you very slowly and carefully approach the razor edge of traction/no traction represented by a controlled drift. By using subtle alterations in swaybar stiffness and leverage, shock-fluid viscosity, piston-hole size, tire camber, toe-in and driving style, you should be able eventually to reach your goal. You'll also learn an awful lot about car setup along the way! The new, softer-compound tires and stiff blue-foam inserts available from Associated should also give you more tuning options.

No Swerve-o from the Servo

I have a Kyosho USA-1 Nitro Crusher, and I think it's the coolest thing around. My only problem with it is that it won't turn very well. In fact, I can't turn it around in the width of a two-lane street! I bought a new servo, but it didn't help very much. Should I loosen my rear differential? I'm afraid that if I do that, something will wear out. Please help!

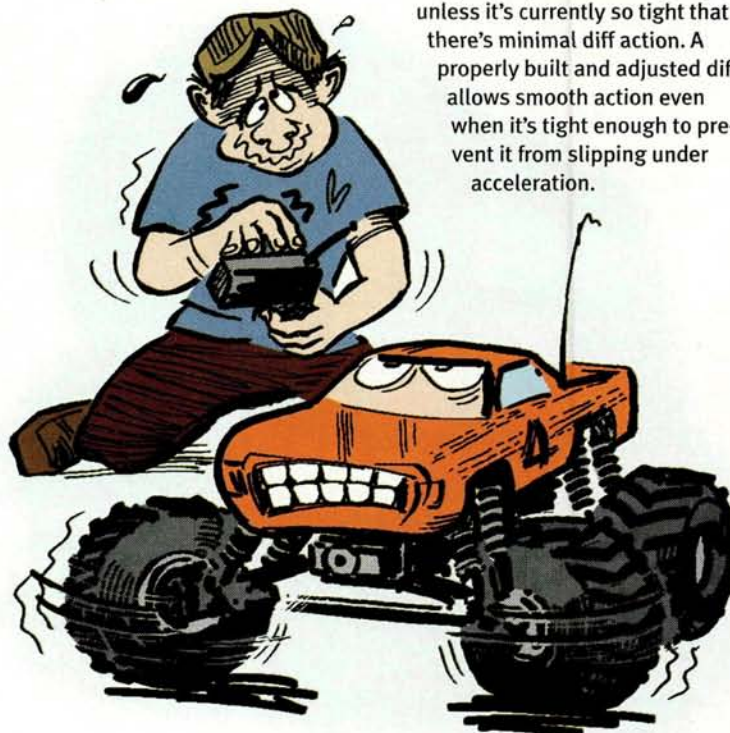
JUSTIN FOTE
Highlands Ranch, CO

Justin, I agree that the Nitro Crusher is extremely cool! But as you've discovered, it's much better at straight-line car crushing than at dodging around corners. Unfortunately, all straightaways must eventually come to an end, at which point you'd better be able

to get things moving in the necessary direction.

To start, I suggest you disconnect the steering linkage at the servo and check to see whether you have full lock-to-lock steering. Sometimes, the linkage itself can become misaligned and cause the wheels to stop before they reach full throw. You may even need to do a little "re-engineering" to get full steering throw. Once you know the wheels will actually reach full left and right, reattach the servo and see whether it limits movement. You may find it worthwhile to invest in a larger servo saver to extend the servo's throw (Kimbrough makes an excellent unit that's designed for the rigors of gas vehicles).

I agree that loosening the rear diff probably isn't the way to go, unless it's currently so tight that there's minimal diff action. A properly built and adjusted diff allows smooth action even when it's tight enough to prevent it from slipping under acceleration.



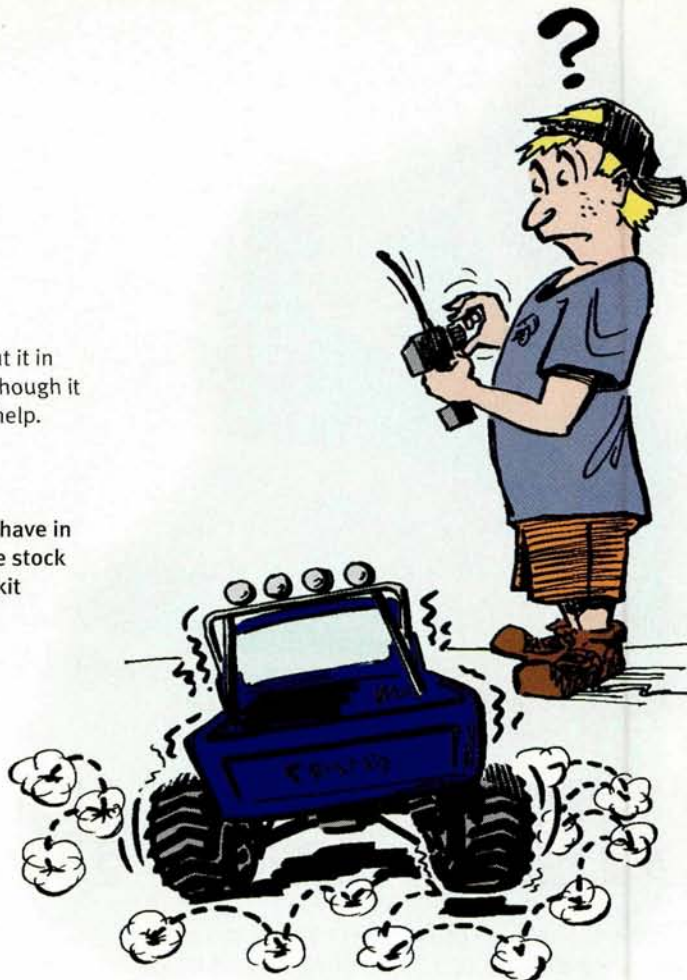
Trigger Trouble

I have a problem with my Tamiya Ford F-150 truck. When I put it in reverse, it just jerks around or doesn't do anything at all, although it works fine otherwise. What's the problem? Thanks for your help.

[email]

STEPHEN SMITH

Stephen, without knowing which kind of speed control you have in your truck, this is a tough one to call. If you're still using the stock mechanical control, read the directions that came with the kit to ensure that your radio and linkage are properly adjusted, and the wiper isn't overshooting the reverse contacts on the board. Those contacts also need to be cleaned and lubricated periodically to remove wear marks and oxidation; dirty or worn contacts will result in exactly the behavior you've described. If you've upgraded to an electronic speed control with reverse, it may be necessary to adjust the travel of your transmitter trigger for more forward and less reverse movement. It isn't difficult to do; your radio's manual will walk you through the process.



Silicone Swap

First, I have to tell you guys what an incredible magazine you have! You do an excellent job month after month, and I really appreciate it. Now, I've got a couple of questions. How do you change the fluid in a Hydra Drive unit? And how do the newer 2.2-inch wheels and tires benefit a car?

Thanks for your time and wisdom.

[email]

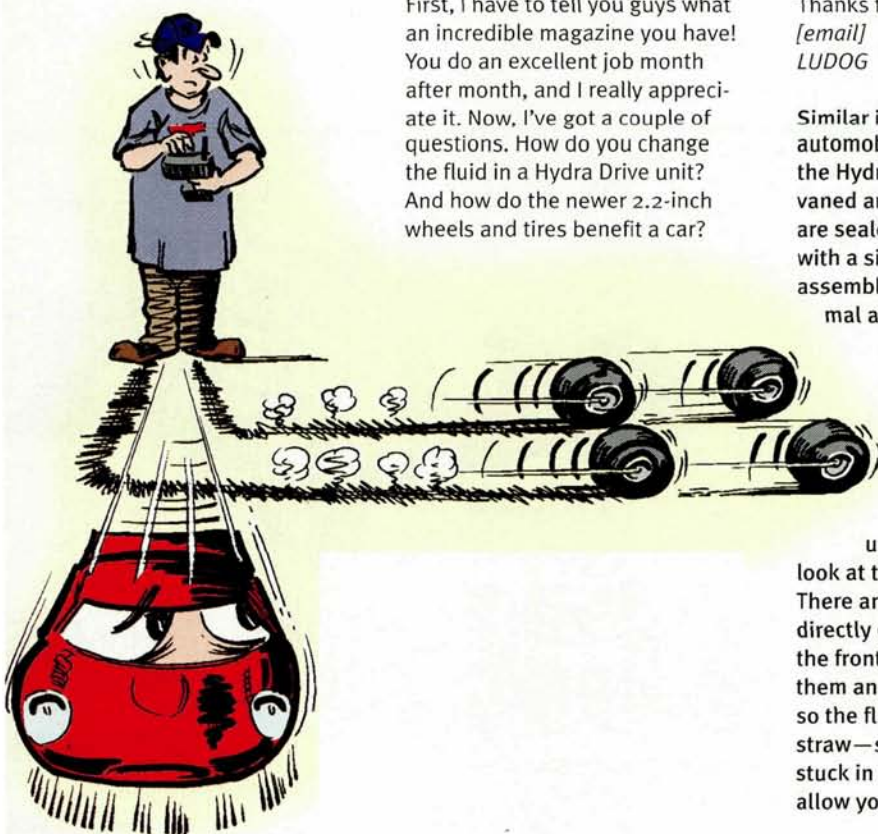
LUDOG

Similar in design to a full-scale automobile's torque converter, the Hydra Drive consists of two vaned and chambered disks that are sealed around their perimeter with a silicone ring. If properly assembled, it operates with minimal attention for extended periods, but when you have to change the fluid to accommodate different tracks, things get messy fast.

Remove the drive unit from the top shaft and look at the face of the outer disk. There are two white nylon screws directly opposite each other on the front face. Remove both of them and tilt the unit to one side so the fluid drips out. A small straw—such as a coffee stirrer—stuck in one of the holes will allow you to blow more fluid out.

If that's not good enough, you'll have to take the halves apart, and as long as you have to do that, you might as well pick up a new set of seals and replace them at the same time.

Now, about those wheels: 2.2-inch wheels and tires in combination have the same diameter as the older 2-inch wheels with their taller tires. That means the 2.2-inch tires have a shorter (and, therefore, stiffer) sidewall. Like low-profile, high-performance tires for your full-scale ride, these result in sharper cornering and better control over tread deformation in the corners. Some cars react dramatically to the installation of larger wheels, while others seem to experience little handling improvement. If you're considering installing larger wheels on your car, first try to drive another car that already has them. Be sure the difference is worth it to you before you take the plunge.



All Those Little Holes ...

Understanding shock-mounting options

So you've just graduated to a "real" competition off-road truck or buggy. You've read the directions, put everything together correctly, found out which tires work best on your local track and asked everyone in sight about pistons, shock fluid, gearing, motor brushes and camber settings. Then, while mounting those ultra-smooth shocks on that trick composite shock tower, you were confronted with not one, but a whole bunch of little holes to choose from. "OK," you think, "I'll just bolt this sucker onto the lower suspension arm and figure out which upper hole I'm supposed to use later on."

That's when surprise number two rears its ugly head: there are three lower shock-mounting holes on the arm! Referring to the pictures in the assembly manual and some issues of *R/C Car Action* that are lying around, you see that cars have their shocks mounted in different holes; what's worse, some of the same models at the same races have their shocks mounted in different holes as well. What's a dazed and confused racer to do?

Don't worry. I'll explain why there are so many mounting locations to choose from and tell you how to decide which ones are likely to work best for you. You'll have to do some thinking and head scratching, but at the end of this little exercise, you'll be able to go faster over the bumps and whoops and amaze your friends and fellow racers in the process.

THE BOTTOM END

Let's break things down and make them easier to understand. The lower arm on a typical off-road car or truck has two or three mounting holes. Using the inner hole, which is closer to the hinge pin/fulcrum, makes it easier for the arm to initiate shock movement, while using the outer hole makes it more difficult for the arm to gain leverage on the shock.

Think of the lower shock mount as a way to tune the initial portion of the shock's stroke.

Here's how you might take advantage of this. Want a little more steering going into the turns? Moving the lower shock mount closer to the hinge pin will allow the front end to hunker down a little more rapidly when you let off the gas; this will transfer weight to the steering

wheels and result in more immediate turn-in.

Having problems with a slippery track right at the entrance to the turn at the end of the straightaway? Move the lower mount of the front shocks outward, and you should find it easier to toss the car sideways without its getting away from you. The suspension arm has less leverage to compress the shock, so less weight is transferred

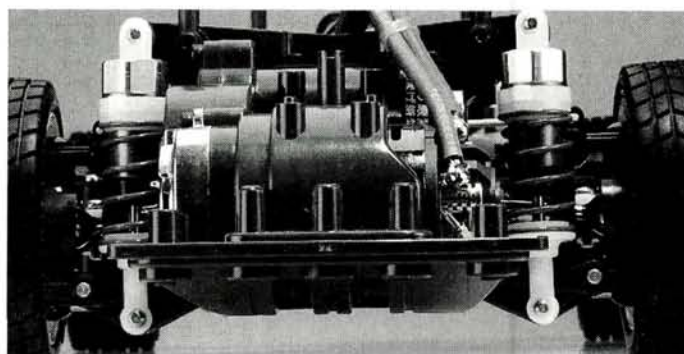
to the front wheels, and that helps prevent the front tires from biting too hard and spinning the car around.

UP TOP

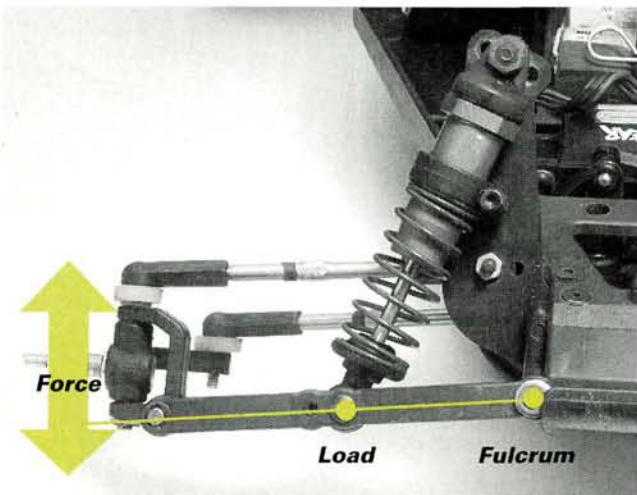
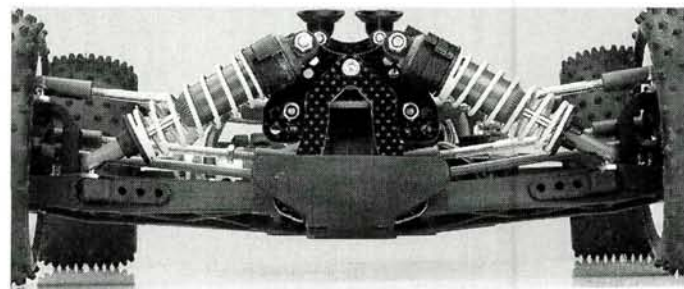
Many off-road machines have three or more upper shock-mounting holes. They work in a similar way to the lower holes, but have a greater effect on the shock as it gets deeper into its range of travel. If the top

of the shock is mounted closer to the inside of the shock tower, it is easier to compress the shock.

However, an R/C vehicle's suspension is a dynamic system; since the lower end of the shock moves in an arc with the suspension arm, the angle of the shock changes with every degree of arm movement. The more vertical the shock is relative to the arm at any given point, the



Shock position varies considerably with application. Consider these two extremes: above, the vertical shocks of a Tamiya TA03 touring car; below, the laydown shocks of Schumacher's CAT 98 4WD off-road buggy.



The A-arm suspension used by virtually all R/C cars is a simple lever system; the suspension arm is the lever, which pivots on a fulcrum (the hinge pin) to lift a load; in this case, the load is the tension of the shock spring and the damping force of the piston moving through the shock oil. The force that operates the lever is supplied by the wheel attached to the arm; jump landings, bumps and cornering loads all use the suspension arm/lever to compress the shock.

WHY SO MANY?

Each mounting option affects the way your car or truck reacts to track conditions and obstacles; for instance, a flat track with soft, loamy dirt and relatively open lanes will require different handling characteristics than will a hard, blue-groove raceway with narrow corner exits and super-long jumps.

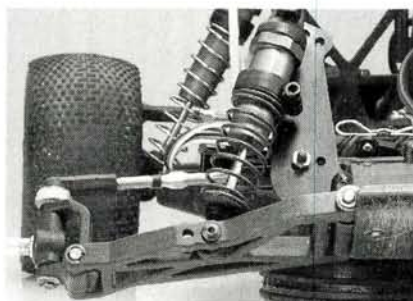
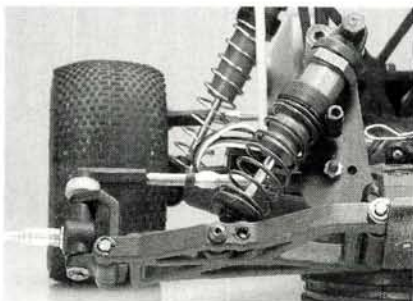
Think of the mounting holes as a means of positioning the load (represented by the shock's resistance) along the lever (represented by the suspension arm). The closer the load (shock) is to the fulcrum (in this case, the hinge pin), the greater the leverage of the suspension arm. As the load is moved outward from the fulcrum, the suspension arm/lever has less leverage.

By using the outside mounting holes, the suspension has a stiffer feel as it is compressed

By using the inside mounting holes, the suspension has a softer feel as it is compressed

Less leverage, "stiffer" feel

More leverage, "softer" feel.



Above left: in this photo, the shock is in its most "laid down" position. By using the outside lower mounting hole, the car should resist chassis roll in high-traction corners, while using the innermost hole on the shock tower helps the suspension action remain supple. This could be a good setup for a smooth track without challenging jumps.

Above right: the "stand up" position shown here delivers the softest suspension action, good for bumpy tracks. The use of the outside upper mounting hole helps prevent the suspension from bottoming out. This setup could serve well on bumpy tracks with big jumps.

more resistance is applied to the suspension arm. If you want less resistance at the end of the shock stroke, move the upper mount in toward the centerline. Moving the upper mount outward has the opposite effect: more resistance at the end of the shock stroke. Since most upper holes are in an arc across the shock tower, you seldom have to worry about altered ride height when making this change, but it is always wise to double check your ride height and be sure the dogbones remain fully seated (if making changes to the rear suspension).

Upper shock-mounting hole changes really help when you're trying to make sure that your car or truck doesn't bottom out on large, multiple jumps. You can move the upper mount a hole or two toward the outside and get a result that's a compromise between your existing spring/fluid/piston selection and a stiffer spring or thicker fluid. Upper mount changes are also handy when the track has a fast downhill section with an off-camber turn at the bottom. Move the upper shock mount out toward the wheel, and the front end will dive less rapidly and lift

the inside wheel less often.

ARE YOU A THINKER?

Off-road racing cars and trucks have so many adjustments and options that it takes a really thoughtful tuner to use each of them to his advantage. Talk to the really fast guys at regional and national events, and you'll find folks who experiment with suspension geometry all of the time to find the optimum balance between traction and travel. If you want to join them in the winners' circle, you'll have to put in some skull time of your own. ■

You spend **HOURS** making your car look **CHOICE** on the outside... why not make it **CRANK** on the inside?



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Keep on NASTruckin'

MANY MODELERS ENJOY creating "theme" vehicles for concours competition. This is my favorite category of concours because I'm free to use my imagination, and I can get as wild as I like. Sometimes, it's easier to go this route instead of trying to replicate a full-size car or truck. Be forewarned if you're creating a make-believe race team, though; it had better be a solid idea with plenty of outstanding detail, as some judges tend to favor replicas of real vehicles. I'm doing a "Mad Dog" SuperTruck, which is inspired by the full-scale "Red Dog" truck.

I used the headlights from Autographics' grill kit. It took some trimming to get the proper fit on the Hot Bodies truck. Close inspection of a full-scale racing truck reveals that its headlights are also vinyl decals.



A lower, contoured front end is the big feature on the '97 Ford F-150 from Hot Bodies. There are loads of details formed into this new shell. I decided the truck's original paint scheme needed some new lines; I kept it simple so it wouldn't detract from the detail work.



Above left: with some creative trimming, the grill fits nicely into the space provided on the truck body. Line work on the hood can be achieved by using thin pinstripes. On the real thing, race teams place duct tape over the air-intake grills to increase or decrease airflow. Above right: the sun visor around the windshield can be painted on the inside or cut from a vinyl trim sheet. The safety straps provide extra protection from debris that might hit the windshield. The clips and safety straps make window changes fast and easy during a pit stop. The windshield on full-size race vehicles is made of 1/4-inch-thick polycarbonate (Lexan).

COOL NEW PRODUCTS

New Decals from Slix Graphics

The no. 37 Kmart/RC Cola (no. 2034-RC9737) trim is now available from Slix Decals. You'll get everything required to give your T-Bird a realistic NASCAR makeover. The 2-sheet set contains major sponsors' logos, car

numbers, contingency clusters, grill, window netting and more. This package is printed in full color on stretchy vinyl. Also included are instructions for the paint scheme and decal placement.



Slix Decals has compiled a "Goody Sheet" (no. 2026-RC97SG) to add the final details to your T-Bird, Monte Carlo or Grand Prix. The sticker sheet includes contingency clusters (for those hard-to-find sponsors). You

also get Chevy, Ford and Pontiac logos and highly detailed grills for them. The 2-sheet set is printed on high-quality vinyl.



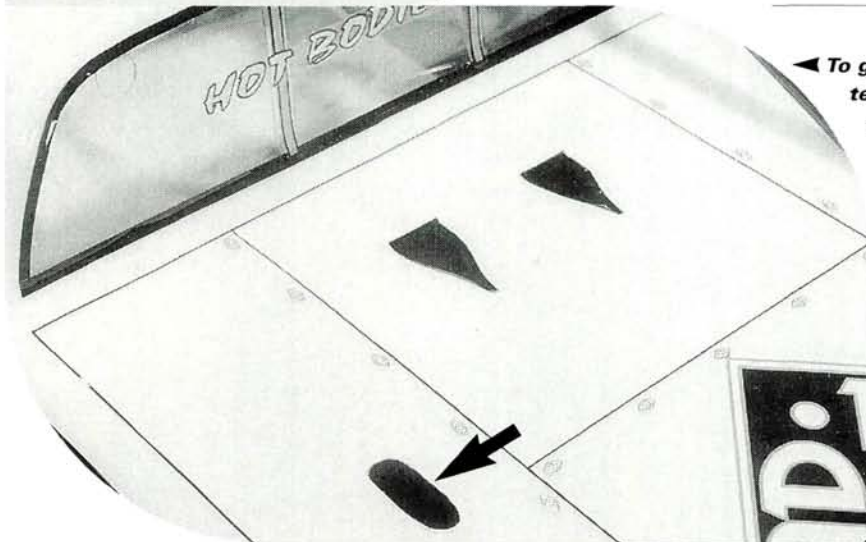
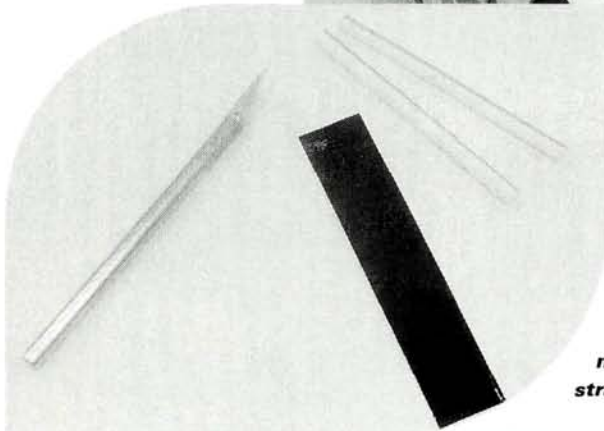
Autographics*, Parma* and Slix Decals* all offer top-quality decal packages that are printed on stretchy vinyl material. This makes it easy to duplicate your favorite race trucks. The "Mad Dog" decal set (part nos. 828 & 170-8A) I chose is by Autographics, and I also used their Truck Cluster (part no. 350) and SuperTruck Ford grill decals (part no. 10831) for this concours project. The graphics will be applied to Hot Bodies'* highly detailed '97 Ford SuperTruck (part no. 10112).

Next time you're glued to ESPN2, take a close look at the headlights on a full-size NASTRUCK. The headlights on a race truck are actually vinyl decals, just like those used on our 1/10-scale vehicles, only bigger. I guess that makes the Autographics decals even more realistic!

I had to trim the headlight decals a little to get the proper fit on the front of the Hot Bodies truck. I made photocopies of the headlight sticker before I actually cut it and then trimmed the paper copy to get the correct size. When you apply the decal, start by lining up the headlight with the grill. Once the placement is right on, apply pressure to the sticker and work from one side to the other, smoothing out the wrinkles and air bubbles as you go. Because these graphics are printed on vinyl, the material can be stretched to conform to the body's shape.

For it to fit nicely into the grill area on the body, the grill decal will also need to be cut. Again, a photocopy for trial fitting ensures the best results. I cut the Autographics grill into strips for easier

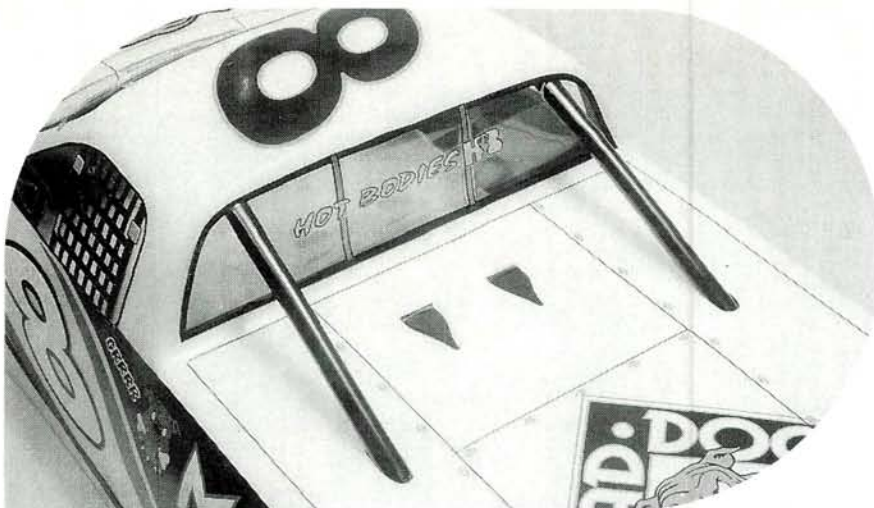
application. To give a clean-looking, finished edge to the outside of the grill, a stripe of Coverite* or MonoKote* can be used as a border. If you're working with a body that doesn't have clear grill lines, scan any super-



truck or race-truck magazine for a close look at the full-size machine's grills; these magazines can be great reference materials.

WRAPPING IT UP

Now it's time to kick back and admire your hard work. A well-done detail job always gives me a feeling of accomplishment. I get an even bigger thrill seeing my scaled-down truck tooling



▲ Roll bars add an extra touch of realism to your truck. Thin pinstripes are used to create the line work for the rear-access panels. The panel retainer screws are included in the Autographics grill kit.

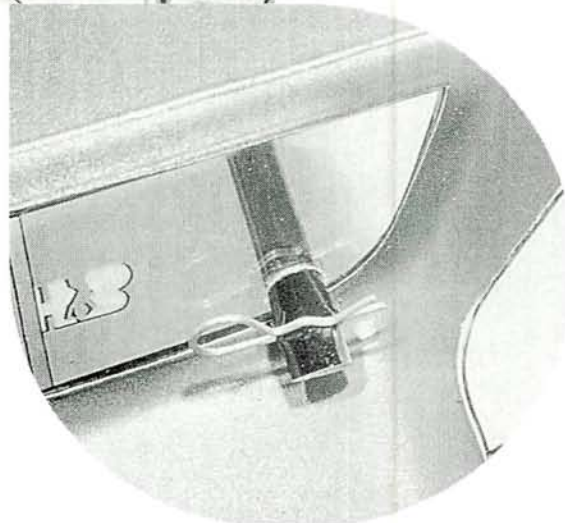
◀ To make these roll bars, use an 8-inch-long plastic drinking straw that has been cut in half. Cut a piece of Coverite or MonoKote approximately 1x4 inches. Roll the straw straight over the Coverite material and when you've finished, you'll have a nice straight seam on one side.

▶ To get the proper fit, drill a slotted hole in the rear deck and a hole in the rear of the cab. Trial fit the roll bar as you enlarge the holes.

▼ Drill a small hole in each end of the straw and secure it with a body clip or twist-tie so it won't come loose while you're racing.

around on the racetrack! With patience, planning and the right materials, you'll have your vehicle in fine shape. I hope you've had as much fun with your project as I've had with mine! Hey, here's the proof; you don't have to win a concours trophy to have a good time with your hobby!

*Addresses are listed alphabetically in the Index of Manufacturers on page 217. ■



Need to know what's new? What works well and what doesn't? This section is devoted to objective reviews of all R/C car accessory items. From gears and wrenches to motor brushes and shock springs; if you can use it with your R/C vehicle, you'll find it critiqued on these pages.



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RPM
Crystal and
Pinion Cases



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Megatech
Rapid Fire R/C
Starting System



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Xipp
Power Jig



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DuraTrax
Streak ESC



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Beat X/Kawada
Superior Hubs

RPM

Crystal and Pinion Cases Case Closed!

If you've been racing for any time at all, chances are you've invested a pretty good chunk of change in spare crystals and pinion gears. So why are they rattling around in the bottom of your toolbox? Protect your investment and organize your gear with RPM's* Crystal Case (part no. 8039) and Pinion Case (8041).

You might think plastic boxes for your pinions and crystals would be no-brainer-type products, but RPM has—as usual—built in some unique features that add another level of convenience and functionality to the simple storage-box concept.

The pinion case holds 15 pinions. There's no need to tighten the pinions on their storage posts; when the case lid is snapped shut, the pinions are held tight. RPM supplies preprinted, self-adhesive labels to stick inside the lid for easy pinion identification. There are also self-adhesive gear-ratio charts for 48- and 64-pitch gears; they fit nicely into the shallow tray that's molded in the bottom of the case. The tray is great for keeping body clips and other small bits handy.

Your crystals are much more delicate than they seem, so stash them away like rare jewels. RPM's case keeps four pairs of crystals safe and secure. To prevent these delicate pieces from bouncing around,



the legs of each crystal plug into molded sockets. Each set of sockets is labeled as "RECV" or "TRANS" inside the case lid, so crystal identification is easy.

The cases are constructed of durable, high-quality plastic and offered in two colors—blue and black; I use a blue case for my FM crystals and a black one for my AM sets. The cases will stay closed no matter how much they bounce around in your toolbox. RPM's pinion and crystal cases have saved me from nicking my pinions and losing crystals more than once, so I've more than recouped their under \$10 cost. Good stuff.

—Kevin Meyer



MEGATECH

Rapid Fire R/C Starting System One-Touch Magic

These days, new R/C'ers often start with a nitro-powered vehicle. Perhaps the availability of high-quality ready to run (RTR) and sport-level nitro-powered kits has something to do with this trend.

Most first-time racers want to get started quickly and easily, so complicated and expensive starter boxes don't appeal to them. For this reason, sport-level nitro vehicles usually have a pull-start engine. Although these engines are convenient and inexpensive, they aren't always easy to use. If an engine isn't tuned correctly, it can be very difficult to turn it over by pulling the starter cord. By the time you get it running, your arm feels pretty numb after all the tugging. This can be especially frustrating if you aren't exactly sure how to tune your engine and the darn thing keeps stalling on you. Fortunately, a new system from Megatech* is here to help. The Rapid Fire One Touch R/C Starting System allows you to start your .12-size glow engines simply by pressing a button. Say goodbye to sore arms.

WHERE TO INSTALL IT?

The Rapid Fire fits the Megatech, Dynamite, HPI, Leo OFNA, O.S. Max, Prafa, Tamiya/OPS and Thunder Tiger .12- to .16-size engines that have pull-starters. If your engine isn't a pull-start, you'll have to install a pull-start crank in it before you can install the Rapid Fire. Although the Rapid Fire will fit most engines, your engine may not fit inside your vehicle with the Rapid Fire installed. A label on its package clearly states that the Rapid Fire unit requires at least 1½ inches of free and usable space on either side of the engine. On some vehicles, header and tuned-pipe clearance will restrict the installation.

If you aren't certain whether the Rapid Fire will fit your car or truck, give America's Hobby Center—

Megatech's U.S. distributor—a call. I've installed the Rapid Fire on the Tamiya TGX and the HPI Nitro RS4. It fit both perfectly, but I couldn't use the optional tuned pipe in either.

The Rapid Fire starter replaces the backplate of most .12 to .16 engines. Here, it's mounted on a Megatech M .16.



Top right: a 380-size electric motor is used to turn the engine's crankshaft via a rugged gear-reduction unit. Above: the push-button starter control box is chassis mounted.

The addition of the Rapid Fire will also add considerable weight to your vehicle, but most recreational racers will find that the system makes starting and operating a nitro-powered R/C vehicle so much more pleasurable that they'll be prepared to overlook the weight disadvantage.

HOW DOES IT WORK?

The system consists of a gearbox with three internal reduction gears and a 380-size electric starter motor. The motor has a small pinion gear that mates with the internal spur gear. The final internal gear has a one-way bearing that slips onto the engine's crankshaft. When power is fed to the starter motor, its high rpm are turned into torque by the gear reduction to turn the engine's crankshaft.

A small ignition box (included) must be installed on the chassis in any convenient location using servo tape or screws. The box contains all the wiring needed to connect it to your vehicle, and it has a start button that turns the nitro engine over while igniting the glow plug. A red light on the box glows to let you know that the glow plug is being ignited.

A separate 7.2V 6-cell battery pack (not included) powers the starter motor and glow plug. The power leads from the Rapid Start's ignition box are equipped with a standard Tamiya battery connector, so battery compatibility should not be a problem.

The Rapid Start also has a built-in 20A fuse that protects the gearbox and starter motor. A flooded engine or an overly tight piston and sleeve could damage the Rapid Fire's internal gears and even cause them to strip. If the starter motor and gearbox are jammed because of excessive engine compression, the fuse will blow before the Rapid Start is damaged. As a safety measure, however, Megatech recommends that you do not run the starter motor for more than 5 seconds at a time.

INSTALLATION

The Rapid Fire is very easy to install and use. Megatech claims it can be installed in less than 20 minutes, but it may take longer, depending on your skill and application. It took me a little over an hour to install the Rapid Fire on my TGX because I did a lot of trial-fitting. I found out the hard way that the Rapid Fire wouldn't work on a tuned-

(Continued on page 62)



Megatech Rapid Fire R/C Starting System

(Continued from page 60)

pipe-equipped TGX; it works fine with the stock muffler, though.

Installation is simple; just remove the pull-start mechanism and backplate from your engine and install the Rapid Fire backplate and gearbox in their places. The Rapid Fire's backplate has one flat side that, according to the instructions, must be installed facing the chassis. In some applications, however, the backplate will have to be installed with the flat side facing the top or one of the sides.

The gearbox comes assembled with the starter motor wired and installed. Simply slip it onto the engine's crankshaft and secure it to the backplate with the three included mounting screws and flat plate. You'll have to test-fit the gearbox to make sure that it will fit on the backplate correctly and to make sure that the engine will still fit your vehicle with the Rapid Fire installed. When you're sure everything fits correctly, remove the three screws and put liquid thread-lock on them before reinstalling them.

With the engine in place, all that is left to do is neaten the wiring (use twist-ties) and mount the ignition box. I used servo tape to mount the ignition box on the right side of the chassis on top of the radio box, and I fed the power leads with the Tamiya battery connector out toward the chassis' left side. My Porsche 911 GT-1 body has the driver and passenger windows removed to allow cool air to circulate around the engine; this allows me to access the start button from the passenger window and install the battery through the driver window. I can start the car without removing the body.

USING THE RAPID START

The Rapid Start is perfect for beginners and nitro nuts. I like that it uses a standard 7.2V battery pack to power the starter motor and glow plug. You can get hundreds of starts out of just one charge, and when the battery needs recharging, just plug it in to a quick charger, and in 15 to 25 minutes, you'll be good to go.

You'll never have to use a glow-plug igniter again, and you'll never wonder whether your glow plug is getting enough power. I've used the Rapid Start repeatedly to start my TGX, and it has never once failed; in fact, I've yet to recharge the 7.2V battery pack. The Rapid Start is also very affordable and a lot easier to use than a typical pull-start mechanism.

—George M. Gonzalez

XIPP Power Jig Battery Building Made Easy

Gluing tires. Bleeding shocks. Pinning diffs. And, of course, building batteries. This is the short list of bumper stuff that balances out everything cool in R/C. I can't speak for the first three items, but the gang at Xipp* has come up with a new jig that should help you build packs painlessly.

The Xipp Power Jig (part no. 60003, \$9.99) consists of an ABS plastic base, a pair of foam-padded "pressure plates" and a hook-and-loop strap to hold it all together. The concept is simple: you squeeze your cells between the two pressure plates with the strap, plopping them into the base and solder away. It's not exactly a rocket-science product, but the Xipp folks have built in some clever details that show a lot of thought. The cells are clamped to each other but not to the base, so once you've soldered the battery bars onto one side of the pack, the cells can be flipped over all at once.

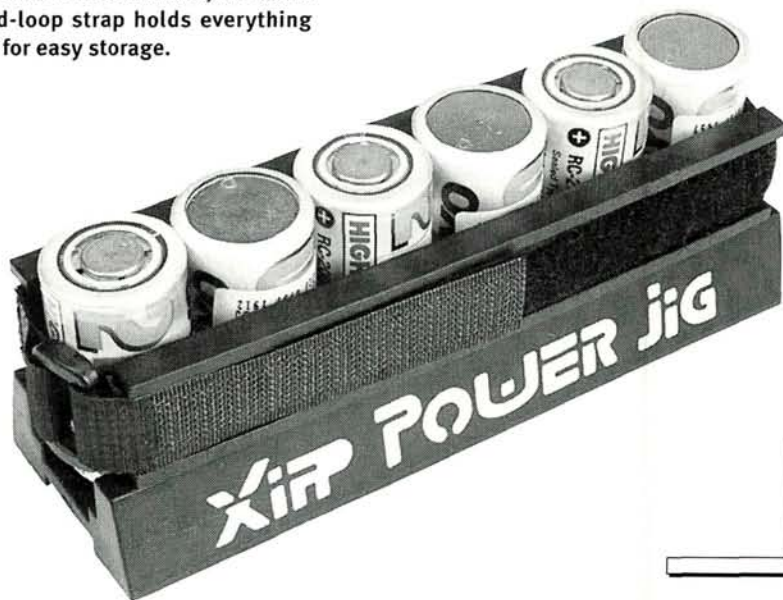
To allow clearance for the battery bars when you flip the pack over, there's a wide channel in the bottom of the base. When you have assembled your pack, the pressure plates stack together and fit into the base, while the hook-and-loop strap holds everything together for easy storage.

I built a bunch of packs with the Power Jig using the Sanyo 2000 cells and RC-1700 cells it was designed for. I was pleased to find that Xipp allowed for the thickness of battery matching labels and shrink-wrap when they designed the Power Jig; the prepared cells fit very precisely into the base with no discernible play. I built packs more quickly and easily with the Xipp jig than with other jigs I've tried, and the completed packs were the straightest and tightest I had ever assembled.

The only hang-up I had was when I used the jig to build saddle packs for my Schumacher CAT 98; once the jumper wire was in place, the jig couldn't hold the pack after I had flipped it over to solder the connector wires. I solved the problem by gripping each 3-cell group separately.

I found the Xipp Power Jig to be a very useful, practical tool, and it's definitely the best battery jig I've used. It's collapsible, so it's also very convenient to store and take along to the track.

—Peter Vieira



DURATRAX Streak ESC High Frequency, Low Price

The number one bit of hop-up advice I give to beginners is this: replace your car's mechanical speed control (MSC) with an electronic speed control (ESC). While it has always held true that even the most basic ESC is much better than a mechanical unit, it used to be that entry-level ESCs often paled beside their racier (and more expensive) counterparts. Times change, however, and we are now in a "golden age" of electronic speed technology. There are more excellent, inexpensive speedos available now than ever before, and many offer features previously found only on high-end units. The new DuraTrax* Streak ESC falls into that category and packs some race-ready features into a dirt-cheap package. Here's what you get ...

FEATURES

The latest buzzword in the world of ESCs is "frequency": the number of times an ESC switches on and off per second to regulate the motor's speed. It is generally believed that the higher the frequency, the better the speedo. The Streak operates at 3500Hz—a frequency as high as or higher than that of many high-end racing ESCs. The higher frequency should make for smoother throttle response, greater efficiency and cooler operation, although the unit's low FET count (three forward, two brake) might cause the Streak to warm up a bit.

Given the Streak's \$79.95 suggested retail price, its high-frequency operation alone would pique my interest in the product; however, the Streak offers more than extra hertz. No doubt, you've already spotted the Streak's prominent adjustment pot; it's not what you think it is, however. It looks like a current limiter, but it's actually a traction-control feature. The pot adjusts the throttle curve in much the same way as the throttle exponential setting of a high-end radio. The Streak uses another feature to help maintain traction while braking: ABS. Like the ABS brakes of a full-scale car, the Streak "pumps" the brakes to prevent lockup. With the Streak's push-button setup, this feature is easily turned on and off. A notable omission from the Streak is an extra lead for FET-boosted servos, although it's doubtful many potential Streak buyers will have such high-performance servos.

INSTALLATION AND SETUP

As part of this issue's "Second Look" article, I installed the Streak in my Kyosho Mantis EP. I snipped off the supplied Tamiya-type connector and replaced it with a Deans plug, and I soldered the motor leads directly to the motor in lieu of using the factory bullet connectors. Although the Streak is set up as a 4-wire ESC, the positive lead for the motor is simply spliced into the battery's positive lead; if you ever wish to hard-wire



the Streak, the more efficient 3-wire-style hookup can be used. A Schottky diode and a pair of capacitors are included with the ESC and were dutifully soldered to the Trinity GT-1 motor I had installed in my car.

Once the Streak had been connected to a charged pack, only a touch of the setup button and the application of full throttle and full brake were required. The Streak uses two LEDs to confirm the forward and brake settings; a green LED flashes for neutral, and a red LED lights to indicate full throttle. Both light when the brake setting has been confirmed. The Streak then oscillates the LEDs for a couple of seconds; you can leave the transmitter alone during this period if you want standard brake action, or you may blip the transmitter's trigger, and the Streak will activate the ABS feature.

PERFORMANCE

Like any over-powered 2WD car, my hopped up Mantis can be tough to drive on some parking lots; apply too much throttle too soon, and the car will spin out. The Streak's traction-control feature did a good job of taming the car's power delivery without limiting top-end speed. Nothing will keep a car planted if you dump the throttle from a standstill, but the traction control does make it easier to ramp up the speed without breaking traction. Dialing out the TC gives the Streak a punchier feel, but top speed isn't affected. In general, throttle feel was very smooth, just as one would expect from the unit's high-frequency operation.

Hard braking was as detrimental to the car's traction as drag-style launches were, so I activated the Streak's ABS function. This proved surprisingly effective; I could actually hear the pulses of brake application as I slowed the car, and I was able to maintain control on all but the loosest surfaces. I could still lock the wheels if I slammed on the brakes, but less aggressive stops were much smoother with ABS. After I had done three packs' worth of hard driving at varied speeds, the Streak's heat sinks were still cool. However, I could not discount the ambient temperature during the test (about 50 degrees) as a contributor to the Streak's cool running.

To further test the unit's tendency—or lack thereof—to heat, I took the car inside and rigged it up with another vehicle so that the Mantis's rear wheels would drive those of the other car. This served as a load for the motor and ESC. I then dialed in about 1/3 throttle at the transmitter's trim pot to serve as an "autopilot" and let the car run this way until the battery dumped. This sort of partial-throttle, high-load abuse definitely warmed up the Streak, although its performance was not affected and the heat sinks did not become too hot to handle.

FINAL THOUGHTS

Given the Streak's low cost, excellent performance and useful features, it's a hard unit to find fault with. True, compared by specs alone, the Streak is at a disadvantage to racing ESCs in the "on" resistance department at 0.004 ohm, but I wouldn't be too concerned about it; the unit's performance belies the numbers on the spec chart, and let's be honest: price counts for a lot, and the Streak is quite affordable. This is DuraTrax's best speedo to date, and it's well worth a look if you're in the market for a high-quality, affordable ESC.

—Peter Vieira

Manufacturer's Specifications

Cells	4 to 10
BEC	5V
Resistance (ohm)*	0.004
Forward current	300
Frequency	3500Hz
Dimensions**	1.6 x 1.5 x 0.6 in.
Motor limit	12-turn

*Transistor rating at 25°C junction temperature

**Without heat sink

BEAT X/KAWADA Superior Hubs Spaced-Out Hubs

Kawada's* lightweight, aluminum, Superior Hubs are precision-machined and designed to fit Tamiya, Kyosho, HPI and similar touring cars that use 4mm axles with hex-hub adapters. The Superior Hubs are machined from aerospace aluminum and are CNC-milled to remove as much material as is practical without sacrificing the part's structural integrity. As a result, each hub weighs a mere 0.3 gram with the drive pin installed!

Unlike the stock plastic hex hubs that slide over the axles after the drive pins have been installed, the Superior Hubs slide onto the axle first, and the drive pins are then installed through the hubs. Once the drive pins have been installed, rubber O-rings hold them in place—a cool feature because the drive pins won't fall out and get lost every time you remove the wheels from the vehicle. In addition, the Superior Hubs fit the axles with greater precision and include axle spacers that eliminate unnecessary play.

Superior Hubs are available in four offsets (widths) that could be used to increase your vehicle's track (width) and were designed to bring narrow touring cars right up to the 190mm maximum-width ruling.



- Normal offset hub—part no. Bo1: no offset and will not alter the car's width;
- 2mm offset hub—Bo2: increases a car's width by 2mm;
- 4mm (Bo3) and 6mm offset hubs increase a car's width by 4mm and 6mm (Bo4), respectively.

Use Superior Hubs to widen the front or the rear end of your vehicle to suit a variety of track conditions. For example, installing the normal hubs up front and the 2mm offset hubs in the rear will widen your car's rear track, and this will give your car more steering. Experimenting with offset might earn you lower lap times.

Compared with standard hex hubs, Kawada Superior Hubs offer many advantages: they're lightweight, convenient and tunable. That's a lot of benefits from a little piece of aluminum that weighs less than 1/2 gram!

— George M. Gonzalez



As you can see, Kawada Superior Hubs are masterfully crafted. They were machined with great care to remove as much weight as possible, and thanks to their O-ring-secured drive pins, they're also user-friendly. You can also use them to alter your car's width.

*Addresses are listed alphabetically in the Index of Manufacturers on page 217. ■

thrash
TEST

1/10 scale electric

Tamiya *Blazing Star*

by Peter Vieira

WHENEVER A sport is driven by equipment or technology, you're bound to find guys who are into "soul"—and I don't mean the music of Marvin Gaye. I'm talking about the soul-riding BMX'er who doesn't care that he has one-piece cranks and last year's tires—he just enjoys catching some air—or the soul-snowboarder who cares about carving the lowest, fastest turn just for the pure exhilaration of it, not to beat somebody down the mountain.

There's soul in R/C driving, too. When you're launching off berms just to see how high your car can get, cutting donuts in a cloud of dust, leaping your car off curbs and just enjoying the sheer pleasure of commanding a fun little vehicle by remote control, you're practicing soul R/C. This is the sort of action that Tamiya's* vehicles have always been best at, and "Big T" just might have the most soulful R/C machine going—the new Blazing Star buggy.





PHOTOS BY WALTER SIDAS



KIT FEATURES

With its swoopy body removed, the Blazing Star should look familiar to anyone who has been in the hobby long enough to have owned one of Tamiya's TA01 or '02 sedans. Both were built around the same front and rear gearboxes and tub-type chassis as the Blazing Star, although the '02 had a shorter tub. If you really know your Tamiya genealogy, you no doubt recognize the Blazing Star's chassis as that of the Manta Ray. The Star isn't the first son of Manta Ray; the Terra Conqueror and Top Force came before it. Those were slightly up-spec'd, dedicated off-road machines, however; the Blazing Star is a back-to-basics buggy with a distinguishing set of all-purpose tires to announce its playful intentions.

Those tall tires are culled from Tamiya's sedan-based stadium trucks, and experience tells me they will wear like iron—after all, they're nearly as hard! The tires' lug tread offers a predictable if not tenacious sort of traction that should make the Blazing Star a fun machine to pitch sideways on- or off-road. The 5-spoke wheels are standard-size sedan hoops that open the door to a vast array of aftermarket wheel choices.

Moving inward from the rolling stock, we find nicely plated dogbones leading into the front and rear sealed gearboxes. Both gearboxes feature bevel-gear differentials that require no maintenance and spin with satisfying smoothness. The rear gearbox also houses the spur gear and Tamiya's unique cam-style motor mount. The motor mount features six pairs of holes that are labeled according to pinion size; just bolt the motor into the holes that match the pinion's tooth count (21, in this case), install the mount into the

gearbox, and gear mesh takes care of itself. A wire prop shaft allows the rear gearbox to drive the front unit and completes the Blazing Star's 4WD system.

In addition to their function as drivetrain components, the front and rear gearboxes are also the mounting points for the supple suspension systems at each end of the car. Two-piece lower A-arms and non-adjustable upper links are used on all four corners, and the use of threaded hinge pins eliminates the hassle of E-clips. Tall plastic shock towers support oil-filled, coil-over shocks to do the hard work of absorbing jolts. The shocks feature adjustable preload collars and unique one-piece shock-shaft/piston assemblies; the piston is a flat metal disk welded to the shock shaft, with two flat sides that allow oil to move past the piston. This limits the adjustability of the dampers, but the Blazing Star isn't meant to be a fully adjustable racing rig, and there is still a wide range of damping adjustment available by changing the shock-oil viscosity. I built the bright yellow shocks with the kit's honey-colored "soft" oil.

Once the gearboxes and suspensions have been assembled, they can be bolted into the plastic chassis tub. The tub incorporates a drop-in battery slot (stick packs only) for quick pack changes, and molded bosses accept the steering bellcranks. The steering and suspension parts have a fair amount of play, but this should only increase the car's durability; I value this over extra precision, given the abuse the buggy will no doubt be subjected to. The steering system's threaded tie rods allow toe adjustments—one of the few adjustments available on the Blazing Star. A wide, flexible front bumper and vestigial rear bumper are added as the final steps to complete the rolling chassis.



s p e c s

SCALE 1/10
LIST PRICE \$156.96

DIMENSIONS

Length overall 15 in.
Wheelbase 10.5 in.
Width (F/R) 9.5 in.

WEIGHT

Gross (RTR) 3 lb., 7 oz.

CHASSIS

Type Molded tub
Material ABS plastic

DRIVE TRAIN

Type Shaft-driven 4WD
Primary Pinion/spur
Transmission Dogbone/stub axle
Differential(s) Front and rear bevel gear
Bearings/bushings Bushings

SUSPENSION (F/R)

Type Lower A-arm
w/upper link
Damping Plastic coil-over,
oil-filled shocks

WHEELS (F/R)

Type 5-spoke molded
plastic
Dimensions (DxW) 2x1 in.

TIRES

F/R All-terrain treaded

ELECTRICS

Motor 540 sealed endbell
Battery Not included
Speed control Three-step mechanical
with reverse

BUILDING & SETUP TIPS

The Blazing Star is an easy kit to build and an ideal choice for the beginner. The best advice I can offer is this: follow the instructions. Tamiya kits are well known for their excellent manuals, and the Blazing Star is no exception. However, there's always something to be learned from experience; here are a few extra tips to help assembly go even more smoothly:

■ The thin heat shield that fits between the motor and its mount is a friction fit on the stock motor, but it's loose on aftermarket cans

such as the Trinity Opal I used. To avoid a frustrating balancing act as you try to line up the holes in the motor, heat shield and mount, use a small piece of tape to tack the heat shield onto the motor. Once the screws have been started, remove the tape, then finish tightening the screws.

■ Be sure to accurately center the steering servo before you install the servo saver. You won't be able to get at the servo horn mounting screw once the servo is in the car.

■ A little rubber cement on the hubs' crosspins will prevent them from falling out whenever you remove the wheels.

■ Remember to install the prop shaft when you bolt the front and rear gearboxes into the chassis. I forget to do this whenever I work on the car!

■ Here's an old trick from the TA02 sedan days: replace the plastic prop-shaft cups with 1/2-inch pieces of fuel tubing for slightly less shaft wiggle.

YOU'LL NEED

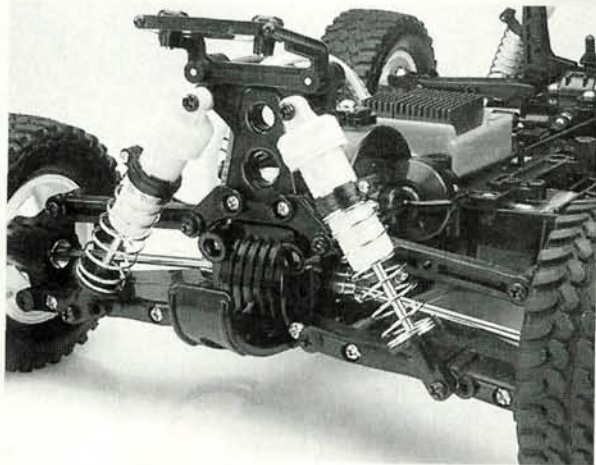
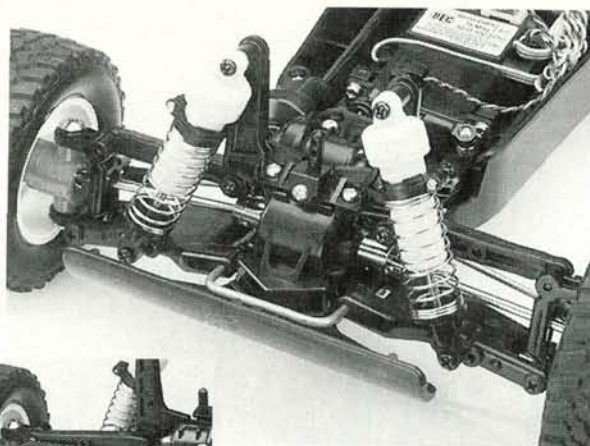
- Stick-type 7.2v battery.
- Battery charger.
- Lexan-compatible paint.
- Two-channel surface-frequency radio with two servos, or a servo and ESC.

FACTORY OPTIONS

- Hi-Cap damper—part no. 53037.
- Manta Ray ball-diff set—53070.
- Stainless-steel propeller-shaft set—53079.
- Lightweight kingpins—53141.
- Aluminum motor mount—53142.
- Carbon gear-shaft set—53164.

TAMIYA BLAZING STAR

Right: a wide, flexible front bumper helps keep the suspension arms where they belong—on the car! The large plastic dampers work well. **Below:** the Blazing Star's wide stance and rugged construction are evident in this photo. Though small, the rear bumper saves the shocks from much abuse.



Unlike other Tamiya shocks I've encountered, the Blazing Star's dampers use these one-piece, non-adjustable piston/shock shafts. You can't swap pistons, but look on the bright side: no E-clips! Right: The Blazing Star uses chunky, all-terrain treads to get the power to the ground.



No car is really complete without a body, though, and the Blazing Star has a sharp one. The polycarbonate shell's low-slung, Coke-bottle shape lends the Star an aggressive look, and a complete set of decals combined with a single-color paint job delivers an exceptional finish. Trimming the body is simplified by cutouts at the top of the shock-tower gates, and a pre-cut body mount and antenna holes make for a perfectly aligned shell. I'm bummed that Tamiya

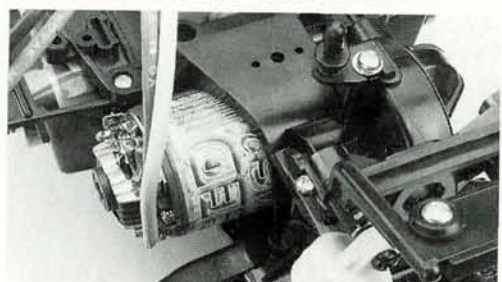
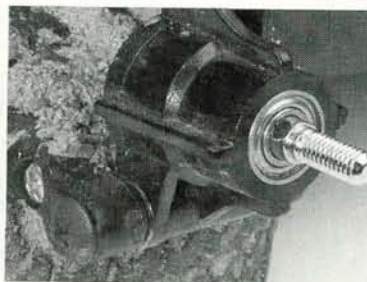
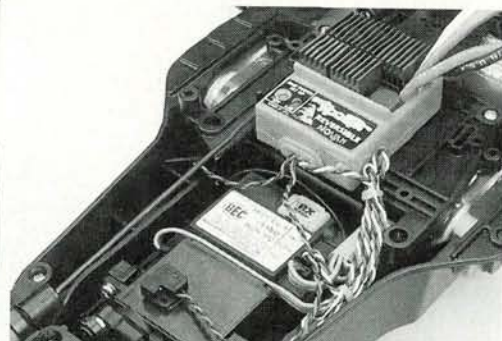
COMPETITION

THE

	Kyosho LAZER ALPHA	Tamiya BLAZING STAR	Schumacher CAT 2000 ECS	Yokomo HOT DOG
Wheelbase	10.7 in.	10.5 in.	11 in.	10.5 in.
Width	9.4 in.	9.5 in.	9.5 in.	9.5 in.
Weight	3 lb., 4 oz.	3 lb., 7 oz.	3 lb., 6 oz.	3 lb., 8 oz.
Diff type	Gear	Gear	Ball	Ball
Chassis	Kelron	Plastic tub	Fiberglass plate	Fiberglass
List price	\$169.99	\$156.96	\$369.50	\$180
Available at*	\$129.99	\$119.99	\$221.70	NA
Reviewed in	To come	-	2/97	10/96

*Prices vary with location.

JR radio gear and Novak's Super Rooster power the Star. There's no shortage of space in the cavernous tub chassis.



Above left: Boca Bearing's Ultra Seal bearings kept the crud at bay. If you run your cars in the wet stuff, these are the bearings to get. **Above right:** a Trinity Speedgems Opal mod motor provided ample power during the Blazing Star's test. The plastic gearbox does little to keep the motor cool, however, so it's a good idea to let the car rest between runs.

doesn't include window masks or overspray film, but I'll live.

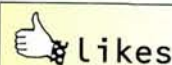
TEST GEAR

To get you rolling at minimum expense, the Blazing Star includes a mechanical speed control and uses bushings throughout the drive train. These items work fine, but they are maintenance intensive, especially if you drive the car off-road. To increase performance and reliability, I replaced the kit's equipment with the following items:

- Novak* Super Rooster ESC.
- Boca Bearing's* Ultra Seal ball bearings. These are very precise, tightly sealed (as the name implies) and lubed for life. I wanted my Blazing Star to be a zero-maintenance machine, so Ultra Seals were the perfect choice.
- Trinity* Opal 10-turn triple motor. Overkill? Probably. Fun? Undoubtedly. This sort of power is usually out of the question for a reversing ESC, but the

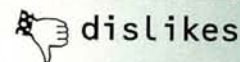
Super Rooster does not specify a motor limit. Bring it on!

- Trinity* Thunder Sport pack for power. Out of the box, the Super Rooster and Thunder packs include Tamiya connectors, but I added Deans* plugs to match the rest of my batteries and ESCs.
- A JR* Python radio and its NES-507 standard servo control the whole magilla.



- Nearly indestructible.
- Stable handling in all but the most extreme conditions.
- Goes anywhere!
- Unique looks.

- Poor airflow is tough on motors.



PERFORMANCE

I took the Blazing Star to a local schoolyard for some fun on a variety of surfaces; from asphalt parking lots to grass soccer fields and everything in between, the Star tackled it all. On pavement, the long-travel suspension and hard tires make for quite a show; there's lots of body roll, and four-wheel drifts seem to go on forever. On really hard turns, the Blazing Star will lift the inside rear wheel, unload the diff and slow the car like a sort of built-in rollover protection.

The Novak Super Rooster added greatly to the car's performance and fun factor. Thanks to the zero-degree timing of the

(Continued on page 202.)

thrash TEST

1/10 scale electric

YOU MAY RECALL our March '98 "Thrash Test" on the HPI* RS4 sport. The car's economical price, high-quality composite parts and superb handling led to a very positive review. Well, HPI has once again waved their magic wands (in this case antenna tubes) and conjured up another sure-fire winner.

This time, the company has addressed the popular and continually growing mini class. The new RS4 Mini electric offers the same performance and economy as the RS4 Sport—smooth, efficient dual-belt 4WD system, dual-plane fiberglass chassis, bulletproof bevel-gear differentials and plastic-body, oil filled shocks. If you're wondering whether it also has the Sport's superb handling traits, read on. For now, I'll just say that this compact unit will certainly provide truckloads of fun and excitement!



HPI RS4 Mini by Greg Vogel

COMPACT C



s p e c s

SCALE 1/10
LIST PRICE \$209.99

DIMENSIONS
Length overall 12 in.
Wheelbase 8.8 in.
Width (F/R) 6.2 in.

WEIGHT
Gross (RTR) 2 lb., 15.25 oz.

CHASSIS
Type Upper and lower plate
Material Fiberglass

DRIVE TRAIN
Type Belt-driven 4WD
Primary Pinion/spur
Transmission Dogbone/ axle
Differential(s) Bevel-gear diff's
Bearings/bushings Oilite bushings

SUSPENSION (F/R)
Type Lower arm w/ molded, fixed upper links
Damping Plastic-body, oil-filled

WHEELS (F/R)
Type One-piece nylon
Dimensions (DxW) 1.2x0.85 in.

TIRES (F/R)
Type M-compound radials

ELECTRICS
Motor, battery, ESC Not included

COMPETITOR



THE KIT

• **Chassis.** The double-deck chassis is cut from G-10 fiberglass stock; the lightweight sub-chassis and upper plate are rigid and, as you would expect, small. I like that the screw holes on the chassis have been countersunk and that the chassis has been dyed black.

The steering servo is mounted upside down on the upper deck—kind of unusual, but space constraints make this the most logical location.

A bellcrank steering system with a built-in servo-saver is hung from the

BUILDING & SETUP TIPS

■ I installed a complete set of ball bearings as I built the Mini. The kit's metal bushings are better than plastic units, but for performance and reliability, bearings are the only way to go. I picked up one of HPI's ready-to-install sets.

■ Be careful when you glue the plates to the pulleys; if you use too much glue, it will squeeze out from the joint and into the pulley's teeth, and that may interfere with the belt's operation.

■ When you trim the flashing off the rear diff's adjuster cams, be careful not to cut off the locating tab.

■ To avoid getting fiberglass splinters, gently sand the edges of the fiberglass chassis and upper deck and knock off any sharp edges.

YOU'LL NEED

- 2-channel radio w/1 servo and an ESC.
- Battery pack.
- Charger.
- Paint.
- Tools for assembly.
- CA glue for tires.

FACTORY OPTIONS

- RS4 Mini main chassis graphite—part no. A576.
- Ball diff set—A508.
- Upper deck (graphite)—A586.
- Universal dogbones—A516/A517.
- 2-speed transmission—A285.
- Super shock set—A111.
- Ball-bearing set—B043.



The Mini's oil-damped shocks operate smoothly, while the rigid steering knuckles ride on bushings that are installed in the uprights. The one-piece upper camber links make assembly easier.

upper deck and maneuvers the Mini with precision. A piano-wire drag link connects the two bellcranks.

• **Suspension.** You'll find a combination of high-quality suspension parts from the RS4 Sport and a few pieces borrowed from the Nitro Mini. The lower suspension arms are molded from a rigid composite, and for easier assembly, one-piece molded upper links are used (does anyone actually enjoy threading ball cups onto tie rods?).

The stout front steering knuckles pivot on bushing-equipped carriers, and the stub axles spin on Oilite bushings. I opted to replace the bushings in the front carriers as well as the rest of the car with an HPI bearing set during the assembly process.

The rear end features non-adjustable upper links that are attached to the rigid rear hub carrier.

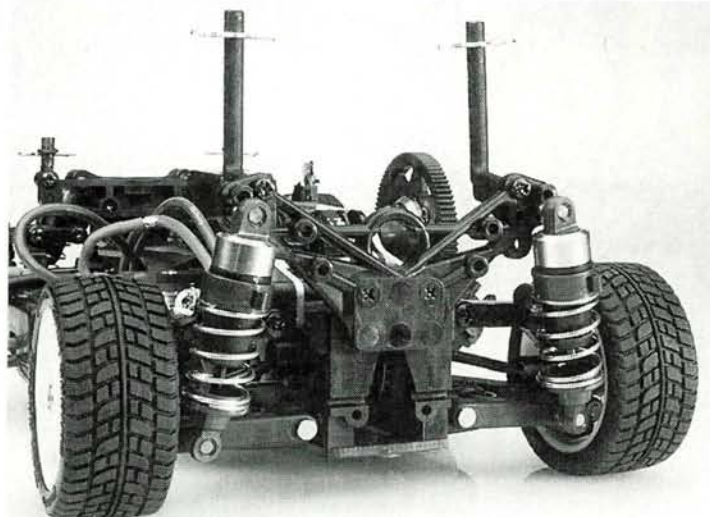
Excellent, easy-to-assemble, plastic-body, oil-damped shocks are on all corners. They come with internal shock bladders that help prevent oil from mixing with air. This simplifies assembly and allows the shocks to function more smoothly. The kit includes spring preload spacers of various sizes to help you tune the car's ride height to suit varying track conditions.

• **Drive train.** The high-quality front and rear gear diffs are easy to assemble. The outdrives are secured to the diff halves with E-clips; this helps to considerably reduce slop—very impressive. The RS4 mini's dual-belt 4WD system is similar to the RS4 Sport's: power is fed to each belt via drive pulleys on the upper layshaft. The layshaft is mounted

between two aluminum plates that are mounted on the rear bulkhead for extra support. One of the aluminum plates is used as a motor mount; it does a great job of dissipating the heat and is a stable platform for the drive components.

Rear belt tension may be adjusted by means of eccentric cams in the rear bulkhead, while front belt tension can be adjusted with a slide tensioner. An 87-tooth spur gear and a 31-tooth 48-pitch pinion gear deliver a gear ratio that provides smooth acceleration and ballistic top speeds.

• **Body, wheels and tires.** Check out the cool Volkswagen Polo body. The real Polo will probably never see our shores because of its ultra-compact size, but it sure looks snazzy mounted on the tiny



The rear bulkhead is open to let out any debris that may get into it. The gear differential operates smoothly and is mounted on eccentric cams to allow adjustment of the rear belt tension.

but mighty RS4 Mini. The paint job was styled by HPI's very own Kent Clausen; how does he come up with these cool schemes?

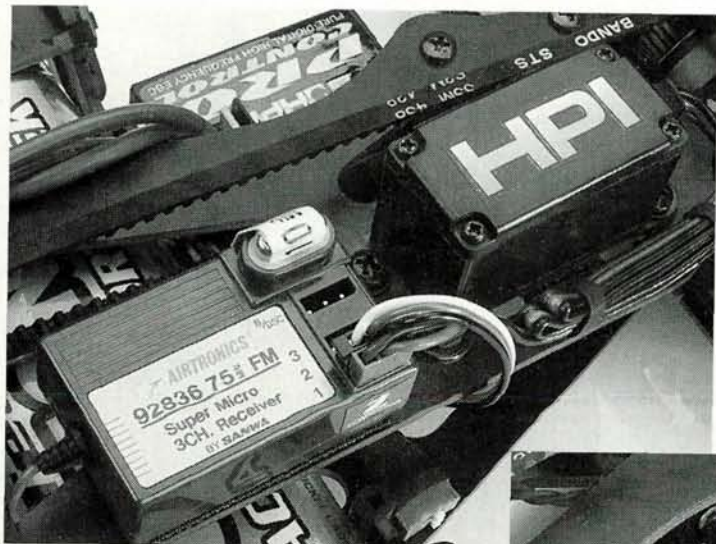
The kit includes a complete set of M-compound radial tires with foam inserts and some sturdy, white, 5-spoke rims.

TEST GEAR

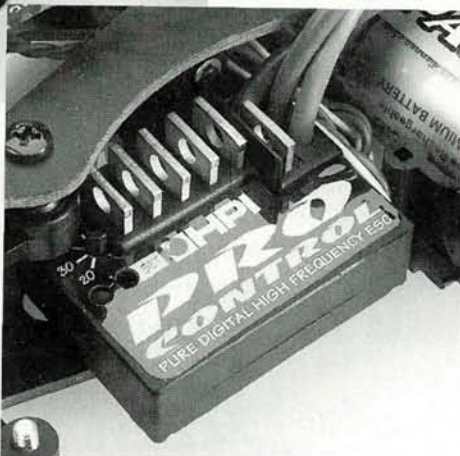
The day the Mini showed up at our office, a top-of-the-line Airtronics* M8 radio system happened to arrive as well. Without a blink of an eye, I made sure that both made their way into my hands and then ran down the hall dodging editor Peter Vieira the entire way (thank God the G-Man is in California or he would have

tackled me for sure!). The included 94102 servo easily handles the steering duties and the new 92836 receiver, which happens to be blue, fits perfectly on the top plate. An HPI Pro Control ESC was an obvious choice and fit snugly on the bottom chassis plate. Finishing the electronics are a new Peak Performance* EBX modified motor and a Team Orion* 2000mAh Activated Sport Pack with a Deans* connector.

I chose the Airtronics M8 radio system. The servo and the receiver both feature new universal "Z" connectors and the HPI Pro Control was just the right size to be mounted on the chassis under the steering bellcrank.



These big gears are included to compensate for the mini-size tires.



PERFORMANCE

I went to the usual parking lot to test this compact ride. When I hit the throttle, the Mini took off instantly and seemed to reach the end of the lot in no time. I then made a turn and sent the car spinning, rear end first. I installed a few more preload spacers on the rear shocks; this stiffened the rear suspension so it would not unload in the turn and send the car into a washing-machine-like spin cycle.

I also reduced the steering travel because this little rocket turns on a dime, and I didn't want to see what would happen if I cranked the steering at full speed running the hot modified motor.

The Mini sped off again, did a few fancy zigzags and stayed in shape until I really

Likes

- All-around high-quality kit.
- Cool, unique body.
- Fun to drive.
- Smooth, efficient, dual belt drive.
- It's mini

dislikes

- Rear hub carries have to be shaved to fit mini wheels.



Battery changes are a snap! Just pinch the tabs and open the door.



The Mini kit includes HPI's M-compound radial tires with foam inserts. The white, 5-star rims are also stock.

yanked on the steering at full trigger. If the law posted R/C speed limits, the Mini would have chalked up a speeding ticket and several other moving violations as it proved to be an aggressive handler. The stock tires performed well, keeping the car planted on takeoffs and through the turns, and pack changes were quick and easy with HPI's quick-release battery holder.

FINAL THOUGHTS

HPI has produced another exciting car based on the RS4. The RS4 Mini is a welcome addition to the growing mini class, and it's an impressive performer right out of the box. If mini racing has sparked your interest, pick up one of these kits and you'll turn that spark into a bonfire!

**Addresses are listed alphabetically in the Index of Manufacturers on page 217.*

THE COMPETITION

	HPI RS4 Mini	Tamiya 1/10 Mini Cooper	RoadRunner GT0
Wheelbase	8.8 in.	8.25 in.	8.25 in.
Width (F/R)	6.2 in.	6.25/6.25 in.	6.25 in.
Weight	2 lb., 15.25 oz.	2 lb., 13 oz.	2 lb., 12.6 oz.
Diff type	Bevel gear	Bevel gear	Ball diffs
Chassis	Fiberglass	Deep, molded tub	Carbon fiber
List price	\$209.99	\$218	\$325
Available at*	\$139.99	\$126.99	
Reviewed in	5/98	9/95	4/97

**Prices vary with location.*

thrash
TEST

1/10 scale electric

Traxxas 4-TEC

by George M. Gonzalez



Ready-to-run
racer

PHOTOS BY WALTER SIDAS

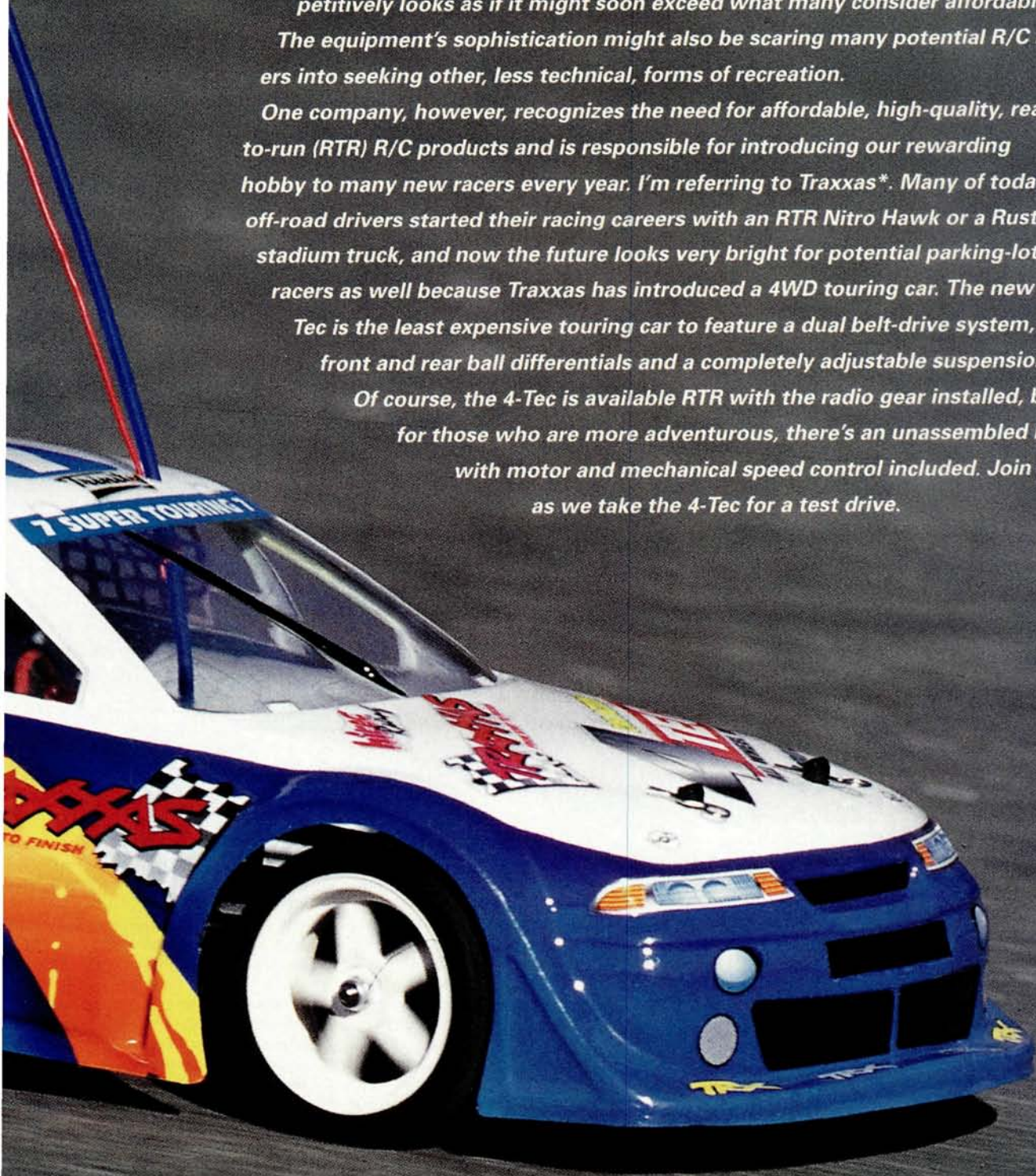
THOSE WHO have been involved in R/C racing for a while have seen it go from a casual weekend hobby to a highly sophisticated and expensive sport.

Newcomers to the hobby are seeing this trend firsthand as touring cars continue to gain popularity. Unfortunately, the cost of racing competitively looks as if it might soon exceed what many consider affordable.

The equipment's sophistication might also be scaring many potential R/C racers into seeking other, less technical, forms of recreation.

One company, however, recognizes the need for affordable, high-quality, ready-to-run (RTR) R/C products and is responsible for introducing our rewarding hobby to many new racers every year. I'm referring to Traxxas*. Many of today's off-road drivers started their racing careers with an RTR Nitro Hawk or a Rustler stadium truck, and now the future looks very bright for potential parking-lot racers as well because Traxxas has introduced a 4WD touring car. The new 4-Tec is the least expensive touring car to feature a dual belt-drive system, front and rear ball differentials and a completely adjustable suspension.

Of course, the 4-Tec is available RTR with the radio gear installed, but for those who are more adventurous, there's an unassembled kit with motor and mechanical speed control included. Join us as we take the 4-Tec for a test drive.



s p e c s

SCALE 1/10
LIST PRICE \$300 (RTR), \$180 (Kit)

DIMENSIONS

Length 17.625 in.
Wheelbase 10.157 in.
Track (F/R) 6.89/7.05 in.

WEIGHT

Gross (RTR)* 3 lb., 3 oz.

CHASSIS

Type Flat lower plate with upper chassis stiffener
Material Molded plastic

DRIVE TRAIN

Type Dual belt 4WD
Primary Pinion/spur
Transmission Universal slider shafts
Bearings/bushings Bearings and metal bushings

SUSPENSION

Type (F/R) Lower suspension arm with adjustable upper control arms
Damping Oil-filled, coil-over plastic shocks

WHEELS

Type (F/R) One-piece plastic
Dimensions (DxW) 2 x 1 in.

TIRES

Front/rear Standard-width rubber slicks

ELECTRICS

Motor and controller 540-size, two-turn Stinger motor and 3-step forward-and-reverse rotary MSC

* Weight is based on 4-Tec equipped with an ESC and super-narrow tires.



KIT FEATURES

• **Chassis.** When you scope out the 4-Tec's chassis and drive-train configuration, the word "conventional" might come to mind. The 4-Tec is unique, however, because of its smart use of composites and its simple but race-proven design. The 4-Tec's flat molded chassis plate is perhaps its most interesting feature. On its own, the chassis plate is fairly

A serious contender and entry-level vehicle, the Traxxas 4-Tec is a wolf in sheep's clothing. The RTR version comes ready to rock 'n' roll just as you see it here.



flexible, but combined with the molded upper chassis plate, it forms a surprisingly rigid foundation. Overall, the chassis is extremely durable and very inexpensive to replace.

The upper chassis plate has a molded-in belt guard that protects the electrical wiring (and your fingers) from dragging on the front drive belt. Although the top plate includes provisions for the installation of a belt tensioner, the 4-Tec does not require one. According to Traxxas, the 4-Tec went through several designs before reaching final production. One of the earlier prototypes incorporated a belt tensioner, but subtle refinements eliminated the need for a tensioning device, and Traxxas does not plan to release the belt tensioner for it. To complete the chassis features, a user-friendly battery holder allows battery access from either side of the chassis.

• **Drive train.** The 4-Tec features a dual-belt 4WD system with adjustable ball diffs at each end of the car. The drive train spins on

YOU'LL NEED

- 6-cell stick pack.
- Battery charger.
- Eight, AA, dry-cell batteries for the radio.
- Paint for the body.
- CA for the tires.

FACTORY OPTIONS

- Two 5x11x4mm ball-bearing sets (for gearboxes)—part no. 4611.
- 5x11x4mm ball-bearing set (for wheels)—4607.
- Swaybar set—4380.
- Reactive-caster wedges—4334.
- Zero-degree stub axles (rear axle carriers)—4354.
- Slipper-clutch set—4615.
- Aluminum shock caps—2667.
- Graphite chassis set w/hardware—4320X.
- Graphite rear shock tower—4317X.
- 5x11x9 ball-bearing set (2 pcs.)—4710.
- 0-degree lower front suspension mount—4329.

BUILDING & SETUP TIPS

Even though our 4-Tec arrived fully assembled, I do have a few building tips that will make your 4-Tec easier to drive and more reliable.

■ Add a drop or two of liquid thread-lock to the 3x8 capscrews that hold the front knuckle arms on the suspension arms. This will prevent the screws from coming loose during a race.

■ Check the screws and nuts to make sure that they're tight. The only exceptions to this are the 3x30 flat-head machine screws that support the steering bellcranks; these screws should only be snug. Over-tightening them will make the steering bellcrank system bind, which in turn will put a strain on the steering servo.

■ After the first battery pack, check the differentials to make sure that

they are not overly loose. The front and rear diffs on our 4-Tec were a little loose after just one run. Check the diffs by placing your thumb over the rear drive belt while securing the left wheel in your hand. With your other hand, try to rotate the right wheel. It should be very difficult to rotate. Check the other diff in the same way. If the differentials need to be adjusted, follow the instructions to the letter. When the diffs have been adjusted properly, you shouldn't have to mess with them for a while.

■ The rear drive belt might seem to be a little loose, but this is an illusion. I fed some serious horsepower through our 4-Tec and never once noticed any signs of belt skipping. Step B-2 in the instruction manual illustrates how to adjust rear belt tension. Each of the differential output yokes fits inside

eccentric cams that in turn fit inside the rear side frames. The eccentric cams have pins that must be properly aligned with the notches on the rear side frames. Rotating the cams backward (counterclockwise) increases belt tension, and rotating them forward decreases belt tension. If you decide to adjust the belt tension, be sure that the left and right eccentric cams have both been installed on the same notch in each rear side frame.

■ Because of atmospheric and temperature changes during shipping, there's a good chance that some of the oil in your 4-Tec's shocks will have leaked out. Do yourself a favor and pick up some silicone shock fluid when you buy the car. If you can, pick up three bottles (20, 30 and 40WT). With this shock-fluid selection, you'll be able to get the 4-Tec hooked up anywhere.

■ Be sure to glue the tires to the wheels with CA. When the stock tires have been glued to the wheels, you're literally stuck with them, so if you have any reservations and think you might want to install stickier tires, don't miss your only opportunity.

■ Put a couple of thin washers on the ball screws that thread into the front steering knuckles. They will allow the suspension arms to pivot more smoothly because the steering rods will not bind with the steering bellcranks.

■ Don't lose the included, optional, hex-hub spacers. They are to be used when installing aftermarket (non-Traxxas) wheels. Store them safely in a small parts box. The parts are available separately as part no. 4375.

Let's go Racing

As your driving skills improve, you'll want to take advantage of the 4-Tec's adjustable suspension. You'll probably also want to upgrade the electronics. To compete with the 4-Tec, you won't need fancy racing equipment. A 2-channel radio system with steering dual rates or end-point adjustments will come in handy to dial out steering, though.

For typical 5-minute heats, you'll do well to get a high-frequency speed control, a competition stock motor and a Sanyo RC 2000mAh stick pack.

Finally, you'll need those sticky tires I've been talking about. Before choosing tires, visit the track you plan to race on and ask the fast guys which tires work best for them. If your club permits the use of super-narrow tires, I strongly suggest that you install a set on your car.

Here's the setup that allowed me to race competitively at the So Cal Raceway.

FRONT END

- Ride height: 3.5mm
- Camber: 1.5 degrees negative
- Caster: both clip-on spacers positioned on the front of the hinge pins (minimum caster)
- Toe angle: zero
- Shock oil: 25WT Trinity
- Springs: optional Street Sport firm black springs—part no. 4267
- Shock pistons: stock 2-hole
- Internal travel limiters: none
- Preload spacers: none
- Shock-mounting location on suspension arm: optional outer hole
- Steering-rod mounting location: stock outer hole on steering knuckle

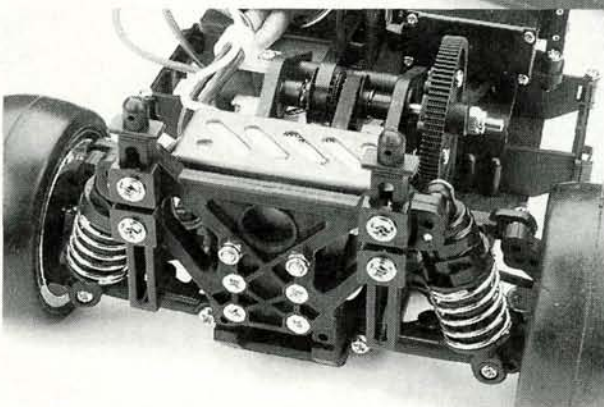
REAR END

- Ride height: 4mm
- Camber: 1 degree negative
- Shock oil: 20WT Trinity
- Springs: stock chrome
- Shock pistons: stock 2-hole
- Internal travel limiters: stock "E" spacer
- Preload spacers: one medium and two thin spacers on each shock body
- Shock-mounting locations
 - on suspension arm: stock inner hole
 - on shock tower: stock lower hole
- Upper camber-link mounting locations
 - on bulkhead: optional lower hole
 - on hub carriers: stock upper hole

ADDITIONAL EQUIPMENT

- Tires: HPI Belted Super Slicks (super narrow)
- Body: Yokomo Lotus GT-1

The 4-Tec's front end is loaded with racing features: ball diff, universal slider shafts, coil-over shocks and independent suspension arms with adjustable camber and caster. That front bumper will save your bacon in a crash. Note the slick, low-profile tires—standard issue.



Adjustable body mounts allow easy body changing. In case you're wondering, that's the heat sink for the mechanical speed control mounted on the shock tower. The rear end features myriad suspension adjustments that allow the tuner to set up the car for a variety of track conditions.

8mm and 11mm metal bushings while the top shaft is supported by 5x11 sealed bearings. Overall, the drive train is smooth and efficient, so the 4-Tec is suitable for stock and modified racing.

Thanks to the ball diffs' newly designed thrust-washer assemblies that feature larger-diameter thrust washers, the diffs are particularly smooth. The diffs may easily be adjusted without any disassembly: just slip an L-shaped 1.5mm wrench into the adjustment hole on the diff housing, line up the diff halves, and rotate the left front or right rear wheel for tension adjustments.

Power is transferred to the ground by means of plastic universal slider shafts. These units are far smoother and more efficient than dogbones, which are commonly found on sport-level touring cars.

The rear gearbox is completely open along the top and toward the back to allow pebbles and small debris that find their way into the gearbox to escape rather than be trapped inside where they could do some damage. The car comes with a 78-tooth, 48-pitch spur gear and 20-tooth pinion gear, but the universal spur-gear mount will accept most popular brands of spur gears. The 4-Tec also features a molded motor mount with slotted mounting holes that allow the tuner to experiment with different gear ratios simply by changing pinion gears.

• **Suspension.** The 4-Tec's highly adjustable suspension is up to snuff with those on many pro-level touring cars. Up front, lower suspension arms with adjustable upper wishbones pivot smoothly on partially threaded hinge pins. Both the upper and lower suspension arms are mounted on 3-degree blocks; this allows the arms to pivot parallel to each other.

Caster may easily be adjusted by sliding the upper wishbones forward (less caster) or backward (more caster). Four caster settings are possible, depending on how the included spacers are installed on the hinge pins. In the stock position, one thick spacer and one thin spacer are installed to the rear of the wishbones; this yields 12 degrees of negative caster. Placing the thin spacer in front of the wishbones and the thick spacer behind them will provide 9.5 degrees of negative caster. Installing the thick spacer up front and the thin spacer in the back will decrease negative caster to 8.5 degrees. Finally, installing both the thin and the thick spacers on the front will provide 6 degrees of negative caster.

Clip-on spacers allow you to position the upper wishbones on the hinge pins precisely for accurate adjustments. Increasing caster will give more turn-in, or initial steering, and less steering when exiting turns. Reducing caster will give less initial steering and more steering out of corners.

Camber may also be adjusted by adjusting the length of the upper camber rod (lengthen to decrease negative camber; shorten to increase negative camber). Generally speaking, increasing negative camber will decrease traction; however, all touring cars require a little negative camber to give the tires a solid contact patch when cornering. As a footnote, our 4-Tec came set up with precisely 1.5 degrees of negative camber on all four wheels (according to my handy RPM* camber gauge).

The front steering knuckles have two steering-arm mounting holes that allow you to adjust steering sensitivity. The stock outer hole should be just fine for most drivers, but the inner hole will make the

Likes

- Incredible value.
- Extra-rugged construction (Traxxas quality).
- Ready-to-run fun.
- Great handling.
- Excellent racing potential.
- Highly adjustable, easy-to-tune suspension.

- The molded motor mount may get soft when the running gets hot because the plastic does not dissipate heat very well.



dislikes

steering response a little more aggressive (stick with the outer hole—trust me).

The rear suspension comprises lower suspension arms with adjustable upper camber links. The rear axle carriers have three camber-link mounting holes for added tunability; two lower suspension-arm mounting choices allow you to experiment with the car's roll center. In addition, you have two inner mounting choices for the upper camber link. The stock upper mounting position should work fine on most conditions, but if you need more rear bite, try the lower position. The 4-Tec also comes with a smooth, racing-style bellcrank steering system that pivots on metal bushings.

Smaller versions of Traxxas' molded Ultra Shocks smooth out slight road

own assistant editor, Greg Vogel, to paint the body. I say he did a fine job. You won't have any problems finding replacement body shells for the 4-Tec; because of its "standard" wheelbase and front and rear width, it will accept most touring-car bodies (we're talking hundreds of choices here, folks!).

The 4-Tec comes with cool-looking 3-spoke chrome wheels. They're eye-catching, but the chrome finish doesn't respond well to flexing or hard hits. Like some other plated wheels I've tried, the inflexible shiny stuff can crack or flake when stressed by the flexing of the plastic wheel.

The stock tires will probably last the life of the car, but they'll slip and slide on all but perfectly clean surfaces. If you

decide to install a competition stock or modified motor, think about upgrading to some stickier tires. The 4-Tec accepts standard 12mm hex-hub touring-car wheels, so you won't have any problem finding suitable replacements. Optional hub spacers are provided, and you might need them if you use after-market wheels.

- **RTR electronics.** Our 4-Tec came fully assembled with a Traxxas TQ 2-channel radio system installed. The TQ radio may not have a lot of high-end features, but it has a comfortable grip and a strong signal; it allowed me to drive my 4-Tec all the way down my street—

almost 1/5 mile!

The 4-Tec includes a 3-step forward and reversing rotary mechanical speed control (MSC) and a Stinger 20-turn 540-size motor. This package will get first-time racers up and running quickly and economically, but those who already own radio equipment might consider picking up the unassembled kit and saving a few bucks.

TEST GEAR

To fairly evaluate the 4-Tec, I used my own racing-oriented radio gear and electronics. I swapped the Stinger motor and 3-step MSC for a feature-packed, GM-Racing* Galaxy programmable ESC and a stout Trinity* Midnight competition stock motor. A Hitec* Lynx 2-channel FM transmitter and an HFS-04MI FM receiver manage the radio waves. The Lynx FM has steering dual rate and throttle end-point

adjustments (EPA), and a steering rate override (SRO) feature momentarily bypasses the steering dual rate at the touch of a single button.

Hitec's standard HS 300BB ball-bearing steering servo handles the steering. But with a zippy transit speed of 0.16 second/60 degrees and 49 ounces of torque, the 300BB can hardly be considered "standard"! For the money, it's hard to beat this high-performance radio system. I also replaced the stock pinion and spur gears with a Trinity Zero Gravity 38-tooth, 64-pitch pinion gear and a Kawada* 112-tooth, 64-pitch machined spur gear. These precision-made gears are extremely smooth and quiet. They're also a couple of grams lighter than the stock gears, and that helps to reduce rotating mass (important in stock-class racing).

PERFORMANCE

I decided that So Cal Raceway's (Huntington Beach, CA) tight indoor asphalt track was the perfect place to test the 4-Tec's race-worthiness. This highly technical track features an intricate infield with many switchback turns and a small straightaway that leads into a speed-hungry banked sweeper—the perfect place to test a car's capabilities and a driver's skill.

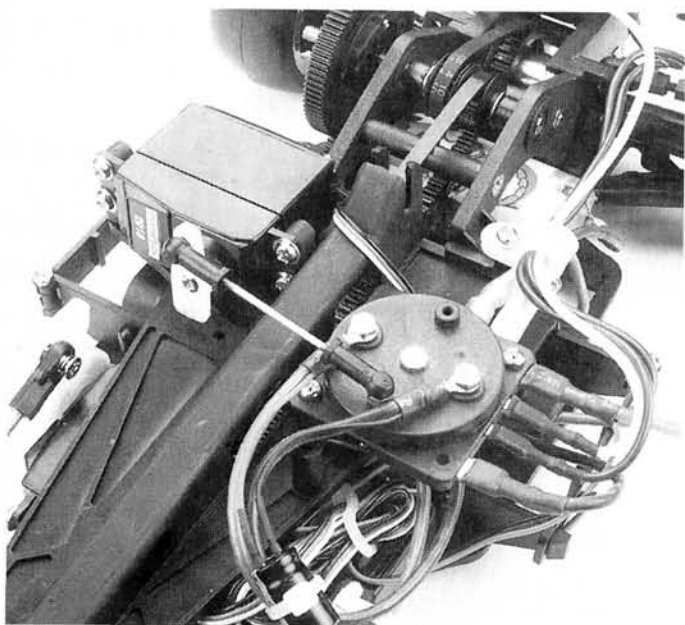
To race competitively in any type of event, you must have right rubber. The 4-Tec accepts standard touring car wheels, so I took along my usual arsenal of tires. Tamiya's Type-A and Pro-Line's S2-compound slick tires suited my driving style just fine. I eventually settled for a complete set of HPI* Belted Super Slicks mounted on Kawada 5-spoke white wheels, however, because they were the only super-narrow tires I had with me. Super-narrow wheels and tires weigh less than their standard narrow counterparts and offer tremendous performance advantages (especially in stock-class racing). I also dabbled with the suspension and came up with a combination that allowed me to race the 4-Tec quite competitively (check out the "Let's Go Racing" sidebar).

It was a slow night at So Cal Raceway, and only a few drivers signed up for the stock class. This meant that no matter how badly I did, I was assured a spot on the A-Main grid (got to love those odds!). As it turned out, the 4-Tec worked very well and I qualified fourth.

During the main, I got off to a great start and managed to hold my position for several laps. Then, just as I started to make my move on the leaders, I noticed that the 4-Tec had lost almost all of its steering. I had to wrestle with it for the rest of the race, but I still finished in fifth place ahead of four other drivers.

When I picked the car up, I noticed that the front left wheel was dangling from the upper wishbone. During the

(Continued on page 202.)



Both RTR and unassembled kit versions include a 3-step rotary mechanical speed control and powerful Stinger 20-turn motor. The RTR version shown here already has the radio gear installed, as shown by the steering and throttle servos.

imperfections. They feature double O-ring seals, bladders, hardened-chrome shock shafts and interchangeable pistons. In addition, the front and rear suspension arms have two shock-mounting holes, and the rear shock tower also offers two shock-mounting choices. As you can see, the 4-Tec has many adjustment possibilities that can help first-time racers hone their tuning skills.

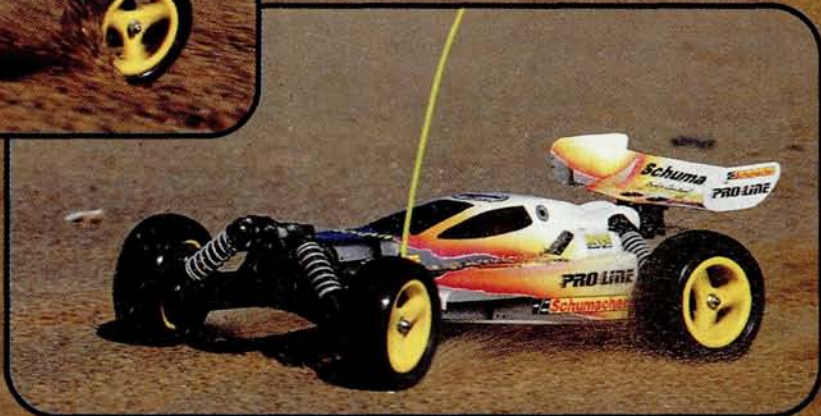
- **Body, wheels and tires.** The included body may look narrower than most touring-car bodies, but that's only because of the huge flared fenders over the tires. The body comes with window masks, colorful decals and a protective outer film to help avoid overspray. Because it was created for the 4-Tec, the body fits the chassis perfectly.

I contracted the services of our very

Schumacher **CAT 98**

by Peter Vieira

DO YOU KNOW which cars took second and third at the '97 IFMAR 4WD Worlds? Don't feel bad if you aren't sure; in our first-place culture, only winners get the press coverage. Second and third places at the Worlds is an impressive showing in anyone's book, though, and both of those podium spots were occupied at the event by Schumacher's* CAT 2000. Team Schumacher has used its experience at the Worlds—as well as its numerous European titles—to create the CAT 98, the most innovative and exciting CAT yet.



PHOTOS BY WALTER SIDAS



s p e c s

SCALE 1/10
LIST PRICE \$529.50

DIMENSIONS
Length overall 17 in.
Wheelbase 11.06 in.
Width (F/R) 9.6 in.

WEIGHT
Gross, RTR 3 lb., 9 oz.

CHASSIS
Type Double-deck plate
Material S1 woven composite

DRIVE TRAIN
Type Dual belt
Primary Pinion/spur
Transmission Blade universal
drive shafts
Differential Ball
Slipper clutch Included
Bearings/bushings Bearings

SUSPENSION (F/R)
Type Lower A-arm
w/turnbuckle upper link
Damping Oil-filled aluminum-
body shocks

WHEELS (F/R)
Type 3-spoke plastic
Dimensions (DxW) 2.2x1.06 in./2.2x1.3 in.

TIRES
(F/R) Schumacher Mini-Spikes,
blue (firm) compound

ELECTRICS
Motor, battery, ESC Not included

KIT FEATURES

The CAT 98's most striking feature is its unique side-saddle chassis, which staggers the required saddle-pack batteries along the right side of the chassis. Schumacher's molded straps hold the cells very close to the chassis' centerline and allow easy pack removal. The CAT 98's battery configuration leaves the left side of the chassis open to accept the ESC, receiver and steering servo, and the motor is deeply offset to the left to help compensate for the weight of the batteries.

A narrow, unbraced top plate stretches across the chassis and bridges the plastic front and rear bulkheads. The completed car exhibits a fair amount of torsional flex but is exceptionally rigid fore and aft. This sort of tuned flexibility is very much in vogue and should result in more forgiving handling; we'll see how it works.

The chassis parts are made of Schumacher's S1 composite, which is woven like carbon fiber but lacks that material's electrical conductivity and the radio glitches such conductivity can cause.

Unique suspension assemblies are hung at each end of the chassis and are the visible trademarks of the CAT 98. With dramatically laid-down shocks stretched over its long lower A-arms, this car bears the look of an innovative racer. The laydown configuration results in a rising compression rate, which should make the car run very flat in the turns, although at the possible expense of rough-track handling and jumping ability. The shocks are hard-anodized, aluminum-body units with bot-



Viewed from above, the CAT's "crooked" belt is easy to spot. Note the battery placement and deeply offset motor.

tom-loaded, screw-in seals. Schumacher has omitted volume-compensation bladders in favor of a trick foam sleeve system that's built into the seal assemblies. As oil is displaced by the shock shaft during compression, the extra oil is forced into

BUILDING & SETUP TIPS

The Schumacher CAT 98 is not difficult to build overall, but its manual requires more careful study than some other kits'. Here's what to look out for:

■ Page 2, step 3: carefully note the order in which the suspension arms and pivot braces are slid onto the hinge pins. The illustration is clear if you follow the arrow that indicates the path the hinge pins take through the parts, but if you just casually look at the layout of the parts in the exploded view, you may assemble them incorrectly (I did).

■ Page 3, steps 1-3: this step is a pain in the, uh, posterior. The assembly isn't complex, but it does require that a couple of pins be fit into the transmission's layshaft. The pins slip in without any friction to hold them in place, and they're perpendicular to each other. That means when you hold the shaft to keep one pin level so it doesn't fall out, the other pin is vertical and slips out. Very frustrating! Make life easier: use a little rubber cement to keep the pins in place—they won't fall out while you're building, yet remain easy to remove.

■ Pages 7-8, steps 10-11: the long, 30mm capscrews that secure the transmission will go in much more easily with a little soap, silicone, or beeswax for lube.

■ In general, you'll find assembly is much easier if you use the correct Posi-type screwdriver. While a regular Phillips screwdriver will work, the Posi-driver is much more effective, and it's easier on the fasteners. To find one, check the better-stocked hardware stores, or order direct from Schumacher.

By the way, Schumacher includes a tool to fit their ball ends (Schumacher calls them "ball grippas"). The manual says it's included, but I couldn't find it. I overlooked it because it's fiberglass, not metal! The tool is the only non-black piece of material in the kit.

YOU'LL NEED

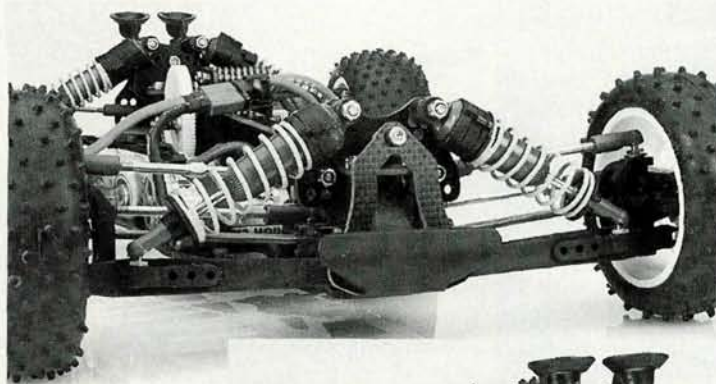
- 2-channel radio set with one servo (high speed/high torque preferred).
- ESC.
- Motor.
- Lexan-compatible paint.
- Six-cell pack in 3x3 saddle-pack configuration.
- Battery charger.

FACTORY OPTIONS

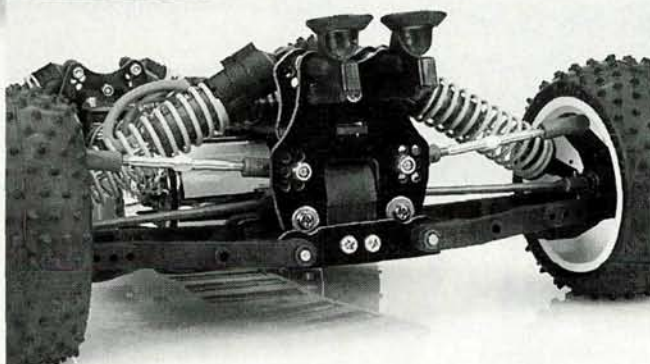
Purple alloy transmission housings:

- Front—part no. U1745.
- Rear—U1563.
- Upper—U1867.
- Alloy one-way pulley set—U1910.
- Layshaft one-way and slipper clutch—U1912.
- Viscous drive unit—U1787.
- Layshaft; alloy one-way and Viscodrive—U1911.
- Alloy rear pulley—U2019.
- Rear anti-roll bar—U1822.
- Titanium full turnbuckle and pivot-pin set—U2023.
- 1/4x1/8-in. steering bearings (two pairs)—U1248.
- 4x8x2mm bearings for center of diff (pair; one pair per diff; two for complete car)—U1419.
- Tungsten-carbide diff balls (4mm)—U1475.
- Tungsten-carbide thrust bearing—U1954.
- 5-degree caster block—U1532.
- Toe-in hub carriers:
 - 1-degree—U1796.
 - 2-degree—U1797.
 - 3-degree—U1789.
 - 4-degree—U1799.

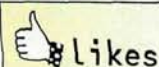
SCHUMACHER CAT



The shocks are installed at a very shallow angle, which gives the CAT a rising-rate suspension system. Much of the car's cornering prowess lies in this design.



The rear shocks are attached close to the hub and feature a laydown position like the front units'. The highest point on the chassis is scarcely higher than the tops of the tires!



- Innovative belt routing.
- "No-wire" wing mount.



- Instructions not as clear as some other kits'.
- Oddball Posi screws require special tool.

an open-cell foam ring. As the shock rebounds and the shaft extends, the oil flows back into the shock body.

Another bit of trademark Schumacher technology is the Vari-shock piston design that features a two-piece piston. Depending on how the pieces are arranged, holes of different sizes can be selected on the piston to vary damping. Although it is still necessary to open the shock for this adjustment, the design does eliminate the need to dump the oil from the shock or pop off E-clips.

Although the steering parts are carry-overs from the CAT 2000, the CAT 98 calls for a different assembly of the dual bellcranks. To accommodate the left-side servo position, the left and right bellcranks have swapped sides. The built-in, adjustable servo-saver is now part of the left bellcrank, and the lever arm that's linked to the servo now uses a fiberglass adapter ring to adjust the arm's offset for proper steering geometry. Brass bushings keep the system operating smoothly.

The CAT 98's drive train is both traditional and revolutionary. The traditional

part is the dual-belt system that drives the front and rear ball differentials. A mid-mounted motor spins a slipper-clutch-equipped layshaft that features a one-way pulley to drive the front differential, while another pulley on the same shaft drives the rear diff. The revolutionary aspect of the driveline is the positioning of the belts. Instead of running the belts parallel to the centerline of the chassis, the CAT's entire drive train is mounted at a shallow angle; if you view it from overhead, the "crooked" spur gear, canted motor and off-center front belt are apparent.

To understand the benefits of this design, imagine the Schumacher with the more typical parallel-with-the-centerline belt configuration. Since this design calls for two belts to be spun off the layshaft, only one belt could be centered in the chassis; the remaining belt would have to be offset (let's say it's the front belt). In turn, the front differential would then also be offset in the chassis. The off-center diff would then require a wider bulkhead and unequal-length outdrives to compensate for the offset. The required wide front

bulkhead would effectively diminish the maximum possible length of the front suspension arms, and the arms would require correspondingly shortened drive shafts. In combination with the less-than-long arms, this would limit suspension travel.

Schumacher's elegant solution permits the CAT 98 to house its diffs in extraordinarily narrow bulkheads and puts the saved space into extra-long suspension arms. Those off-kilter belts don't seem so weird anymore! But as the cliché says, there's no free lunch. As accepted suspension wisdom has it, the angled diffs will increase the left rear suspension's tendency to squat under acceleration, while producing the opposite effect on the right. Only track testing will reveal the true advantages and liabilities of the design.

In addition to its innovative drive-train layout, Schumacher has also broken new ground with the CAT's Blade drive shafts, which feature universal joints and a unique interface with the diffs' outdrives. Traditional dogbones use a small, hardened pin to engage the outdrive directly. The surface area of the pin is very tiny, and it's subjected to tremendous loads that quickly wear the outdrives; this causes slop and backlash. Schumacher also uses a pin design, but the pin never contacts the outdrives. Instead, a horseshoe-shaped plastic piece—the "blade"—rides on the pin, and it is the plastic that engages the outdrives. This minimizes outdrive wear and virtually eliminates play in the axle/drive shaft/diff assembly. It's a solid system that leads me to expect an ultra-smooth power delivery.

The final link between car and track is the tires, of course. Schumacher supplies a set of firm compound spikes that are a hot setup on grass, the racing surface of choice on the European racing scene. But these treads are of dubious value on the blue-groove surface I had in mind for my track testing, so I installed a pair of Pro-Line* Holeshots on each end of the car. These were mounted on the included yellow 3-spoke wheels, which look good and seem acceptably stiff.

Completing the rolling chassis are more clever touches such as shock-absorbing O-ring wing mounts and an integral heat sink/motor mount. A swoopy body with undertray helps keep crud out of the drive

COMPETITION

THE

	Schumacher CAT 98	Tenth Technology Predator Team Car	Team Losi XX-4	Kyosho Laser ZX-S
Wheelbase	11 in.	11.19 in.	10.7 in.	10.75 in.
Width (f/r)	9.5 in.	9.75 in.	9.7/9.8 in.	9.21 in./9.45 in.
Weight	3 lb., 6 oz.	3 lb., 12 oz.	3 lb., 10.3 oz.	3 lb., 14 oz.
Diff type	Ball	Ball	Ball	Ball
Chassis	S1 composite	Nylon composite	Graphite composite	Carbon fiber
List price	\$515	\$670	\$499.95	\$849.99
Available at*	\$299.99	\$450	\$289.99	NA
Reviewed in	—	9/96	8/97	NA

*Prices vary with location.

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SCHUMACHER CAT

train and wraps everything up nicely. Let's hit the track!

TEST GEAR

I had been looking forward to getting one of Trinity's* D3 motors out to the track, and the CAT 98 seemed like an ideal host for the gold-plated mill. Novak's* Tempest MAX speedo was chosen to mete out the power from a fistful of Trinity's VIS-matched 2000 cells, and an Airtronics* 94157 servo was bolted in for steering duty. To complete the car, I installed KO Propo's* tiny KR-297FZ receiver and punched "CAT98" into the memory of my KO Mars radio.

PERFORMANCE

I hauled the CAT 98 and all my gear to Long Island Raceway for the regular Sunday club race, armed to the teeth with Pro-Line tires to match the track's rock-hard, blue-groove surface. Once the slipper clutch had been properly set, I found the CAT almost ready to race, straight out of the box. The car did tend to push out of turns, but this was due more to a thin coating of sand on the track than to any car-tuning problems.

As more cars lapped the field, the loose stuff was pushed from the turns, and the CAT's handling improved. In practice, I found the CAT a capable jumper and highly sensitive to steering and throttle input while in flight. Don't stand on the gas if the CAT is nosing, as its rear will drop like a rock. A light touch is all it takes!

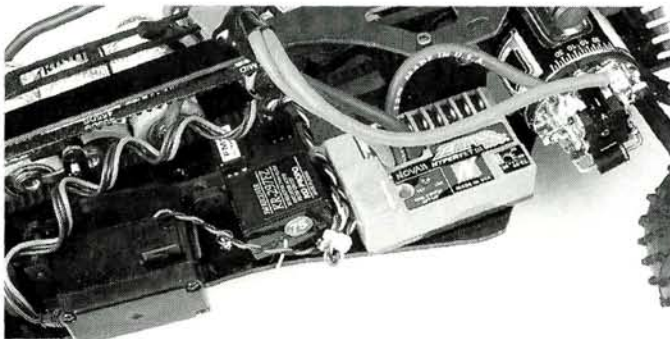
It took only a few laps for me to get the triples down; blasting over all three jumps with a quick burst of D3 power was a cinch, although double-single is usually the faster way through the section. Since the CAT seemed fairly dialed in, I decided to see the first heat's results before starting any wrenching.

The first qualifier went well, although I felt the car still pushed a little more than was healthy for fast lap times. I like a little push; it makes the car more forgiving, but I felt the CAT 98 had more than necessary. I swapped the kit's gray rear springs for Schumacher's blue units; they're the next step up in stiffness. This transferred a little more weight to the front wheels, and from then on, the CAT's fore/aft balance felt just about perfect.

The CAT performed well in the next



Quick-release straps effectively secure the cells. I placed washers beneath the straps to make them easier to operate.



There's no shortage of space for the electronics, even with the somewhat large Tempest MAX ESC in place.

two qualifiers, but there was a weak link in the system—me! I kept making dumb mistakes that pushed me back in the field; each qual was four minutes of catching the leaders, clipping a board, working back up to the leaders, then clipping a board again. The triples were troublesome, too; although I had no problems in practice, I must have cased the jumps on every lap during each race. The CAT took a lot of abuse, but one particularly violent wreck broke a wing mount. The mounts had taken a few good shots previously, and something had to give.

FINAL THOUGHTS

Schumacher's CAT 98 is well suited to smooth, high-traction courses like the one at Long Island Raceway. The car's cornering prowess made it a match for any 4WD on the track, and—like a real feline—the CAT jumped well. The side-saddle chassis, though unconventional, proved well balanced. The car was a pleasure in the pits as well, thanks to the easy-loading battery system and Velcro®-brand fastener-attached body. An entire day at the racetrack without body clips—awright! All in all, an exceptional smooth-track machine. I plan to make the CAT 98 my 4WD car of choice when R/C Madness in Enfield, CT, starts its outdoor season. This should be interesting, as "Madness" is a much softer, bumpier, hurly-burly kind of track. Be on the lookout for a CAT 98 "Second Look" soon!

**Addresses are listed alphabetically in the Index of Manufacturers on page 217.*

top 10

READERS' CHOICE

AWARDS

by the Staff of R/C Car Action

TRUCK

TEAM ASSOCIATED RC10T3

For the second consecutive year, R/C Car Action readers chose an Associated truck. The RC10T2 stole the show last year at this time, and the new RC10T3 now continues that winning tradition. This isn't surprising, though; the T3 is based on the championship-winning RC10B3 and shares most of its hot racing features. Rugged chassis and suspension components and hard-anodized Team Shocks smooth out the roughest terrain. An all-new suspension with improved steering geometry and increased rear-suspension travel give the driver more control on a greater variety of tracks. The stealth transmission with a 2.4:1 final gear ratio features a newly designed slipper clutch that uses fewer parts and a larger slipper pad for greater control in all racing conditions. All these new features ensure that the T3 will continue to be a popular choice among serious racers.



2. Team Losi Double-XT 'CR' 3. Associated RC10GT 4. HPI RS4MT 5. Team Losi GTX 6. Traxxas Rustler 7. Traxxas Nitro Rustler 8. Tamiya Clodbuster 9. Traxxas Electric Stampede 10. Kyosho Dodge Ram

TOURING CAR

HPI RS4 PRO

Since the increasing popularity of touring cars shows no sign of slowing down, we felt the class was due its own spot on the "Readers' Choice" ballot. Your response was clear, and HPI's RS4 Pro secured the number-one spot over some stiff competition. Maybe you picked it because of the low-friction drive system or its excellent durability, or maybe because it downright looks cool. Already a winner on the track, HPI can add another fact to the RS4 Pro's résumé: Readers' Choice Number-One Touring Car of 1998.



2. Team Losi Streetweaver 3. Yokomo YR-4 M2 4. Tamiya TA03 5. Traxxas 4-Tec 6. HPI Nitro RS4 7. Associated RC10DS 8. OFNA Z10 9. HPI Nitro RS4 Mini 10. Megatech Alpha Nitro Tourer

BUGGY

TEAM ASSOCIATED RC10B3

For the last two years, Team Associated's RC10B2 has occupied the number-one slot in the Buggy category. So it is only fitting that the new B3 take over the high-honors position this year. Associated's "Quadrasyymmetric Suspension" makes this car a new animal on the track. The B3 absorbs bumps much better than its predecessor, while maintaining the nimble handling of the B2. When it comes to the RC10 series, number three is number one!



2. Team Losi Double-X 'CR' 3. Team Losi XX-4 4. Thunder Tiger Mirage V-Spec 5. Associated RC10B2 6. Traxxas Bandit 7. OFNA Ultra Worlds GT 8. Yokomo MX-4 9. Tamiya Dirt Thrasher 10. MRC Vortex



PAN CAR

TRINITY SWITCHBLADE

This year, we've added a new category to our "Top 10" awards: pan cars. Although votes were cast for a diverse group of vehicles, one car was your clear favorite: the Trinity Switchblade 10. With its triple-shock rear end, Reactive Caster front suspension, rigid graphite chassis and centered motor design, the SB10 is a force to be reckoned with. In oval circles (no pun intended) the Switchblade 10SS is the ROAR Carpet Oval national champ, piloted by Kirby Hand. With a winning record at the national and club level, we can see why the Switchblade is our readers' number-one choice.

2. Associated RC10L2 3. Associated RC12LC 4. Trinity Switchblade 12SJ
5. TRC Disruptor 6. Parma/PSE Phase 1 7. Bolink LTO Extreme
8. TRC Street Spec 10 9. Bolink Street Spec 10. Team CRC WFOS Oval car

TIRES

PRO-LINE DIRT HAWG II M2 2.2 IN. TRUCK TIRES

A fifth-place winner in the previous Readers' Choice Awards, Pro-Line's Dirt Hawg II truck tires took the Favorite Tire category by storm. This proves that last year, the Dirt Hawg II tires were only just starting to pick up momentum. These realistic-looking meats are perfect for converting your 2WD or 4WD stadium truck into an all-terrain terror. Molded from Pro-Line's super-soft M2 compound, these thumpers will stick to dirt, sand, grass and asphalt like a tongue to a frozen metal post. So, if you're looking to add some scale realism to your ride but don't want to sacrifice performance, pick up a set of Dirt Hawg II tires, and go carve up some trails. The Dirt Hawg II tires include foam inserts and decals.

2. Pro-Line Speed Haws 3. Team Losi X2000 4. TRC Foam Tires 5. Pro-Line Holeshoot 6. Pro-Line Bowtie
7. Pro-Line BowTie Ts 8. Pro-Line Step Pin 9. Pro-Line Gladiators 10. Jaco Foams

CHARGER

TEKIN BC112C

Given the number of BC112Cs we see at the track, we weren't surprised to see this rugged charger as your top pick—again! Sure, it has such cutting-edge features as Power Flex cell conditioning, a cold-start feature for those packs that are tough to get going (we've all got 'em!) and a digital display, but it's also incredibly easy to use, operates on AC or DC power and can charge anything from a single receiver battery to a 12-cell 2000 pack. Best of all, Tekin's BC112C is dead reliable; we have units going on four years old without so much as a false peak!

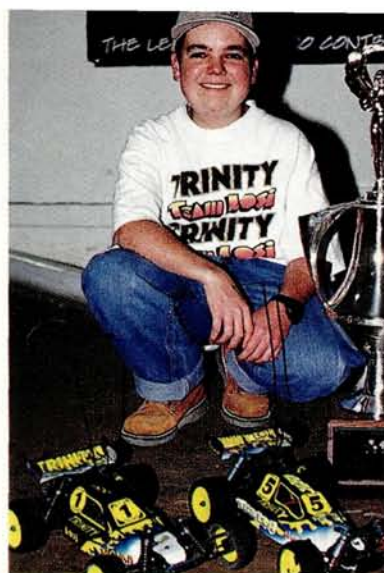
2. Competition Electronics Turbo Thirty 3. Novak Digi-Peak
4. MRC Super Brain 5. Tekin BC67 Pro 6. Hobbico 900
7. Tekin BC112A 8. Apex Sigma 9. Tekin BC5A
10. Victor Engineering Quad IQ



DRIVER

BRIAN KINWALD

Winning for the second year in a row by an incredible landslide victory, Team Trinity/Team Losi factory driver Brian Kinwald is your choice for favorite driver. Brian was top qualifier and first-place champion in the 2WD, 4WD and Truck Modified classes at the '97 NORRCA Nationals. He was also top qualifier and first-place champion in the 2WD, 4WD and Truck Modified classes at the '97 ROAR Nationals. Brian finished his winning streak by taking the win in the 2WD class at the '97-'98 IFMAR Off-Road World Championships—no doubt, a fantastic year! Never in the history of R/C has a driver proven to be so successful. Now Brian can enjoy adding another Readers' Choice Award to all his others. That is, if he still has room!



2. Masami Hirotsaka 3. Mark Pavidis 4. Richard Saxton 5. David Jun 6. Brian Dunbar 7. Cliff Lett
8. Kirby Hand 9. Greg Hodapp 10. Jukka Steenari

MOTOR

MIDNIGHT 2

The original Midnight was no slouch; heck, you picked it as the top motor last year. The gang at Trinity thought they could do better, however, and tapped an all-new design into their CAD machines. The result was the Midnight 2, a "sequel" that definitely improves on the original. The Midnight 2 is the landslide victor in the motor category, with good reason: it's fast and torquey, with an unmistakable flat-sided design that is uniquely Trinity's. In addition to its performance-enhancing design, convenience features are also built in to make life easier in the stock class: the M2's extra-large solder tabs make for easy installation, and the commutator-inspection port in the endbell allows quick comm check-ups. Trinity took a big swing with this motor, and to say they put it out of the park would be a big understatement.



2. Trinity X-Star 3. Trinity D3 4. Reedy Sonic 2 5. Reedy Firehawk
6. MaxTech Shock Wave 7. GM Purple Bull 8. Trinity Sapphire
9. Peak Raven 10. Trinity Topaz

ENGINE

O.S. .12 CV

Some of you voted for this mill with the pull-start, some without; but no matter how you slice it, the O.S. CV line was the big winner. And why not? O.S. has long enjoyed a well-deserved reputation for quality, reliability and performance—a reputation the CV engines certainly live up to. Add a unique Heat-Vent heat-sink head, cool black case and optional pull-start, and you've got a winner for any 1/10 gasser.



2. Dynamite 12PD 3. O.S. 12 CZZ 4. MegaTech M16 5. Nova Rossi BT21BK 6. HPI Nitro Star
7. Dynamite Paris 12 PD 8. O.S. 21RZ-B 9. O.S. 12CZ-R 10. O.S. 21 RG

top 10 8691 READERS' CHOICE AWARDS

SPEED CONTROL NOVAK CYCLONE

For the second year in a row, the ground-breaking Cyclone is your pick for top ESC. Since Novak's visionary design appeared last year, racers have had a whole new world of features to tune for increased performance; the Cyclone's drive frequency, drag brake, deadband and seven other performance parameters are easily adjustable at the track via the aptly named Pit Wizard, or at home with Novak's PC Interface software. Even if you don't opt for the Pit Wiz or PC gear, the Cyclone is still flexible, offering three preset "profiles" to suit your racing application.



2. Tekin G10 3. Tekin G12CIII 4. LRP V6 5. Tekin G9 6. Novak Super Rooster 7. Novak Rooster
8. Novak Tempest Max 9. Tekin Rebel 10. GM ASP

RADIO AIRTRONICS M8

Ah, the M8. So svelte. So feature-packed. So easy to use. Airtronics' new flagship radio caused quite a buzz when the first prototypes appeared, and they've since been spotted in the hands of the hottest drivers. With its 10-model memory, adjustable servo speed, left-hand adaptability, and a passel of other features, it's no wonder so many drivers swear by the M8—your choice for the top radio of 1998.



2. Airtronics 3PS 3. Futaba 3PDF 4. Futaba Magnum Junior
5. Airtronics CS2P 6. JR Propo R-1 7. Futaba 3PJ 8. KO Propo EX-11
9. Hitec Lynx 10. JR Propo Python



BATTERIES TRINITY VIS-MATCHED SANYO 2000

Trinity's VIS (voltage increasing system) technology goes above and beyond the usual cycling procedures with a proprietary process that increases cell voltage throughout the discharge cycle. Combine VIS with the already phenomenal performance of Sanyo 2000 cells, and you've got yourself some unbeatable batteries. They're the cells of choice for Brian Kinwald (you know—the 2WD world champ?) and your choice for top battery.

2. Reedy Zappers 2000 3. Team Orion 2000 4. World Class 5. Trinity Race Tech
6. B&T Blister Packs 7. Trinity Amp Max 8. SMC 2000 9. Trinity GM-Vis 10. Trinity Thunder Sport

BODY PRO-LINE 1997 FORD F-150

This category probably had the widest variety of responses, with everything from minis to dragster shells getting votes. However, only one body can take the top spot, and that honor goes to the Pro-Line 1997 Ford F-150. The popular choice for Associated's T2 and T3, the F-150 represents the usual combo of performance design, great looks and excellent fit you've come to expect from Pro-Line.

2. Protoform RAMbunctious ET 3. Protoform '98 Ford Taurus 4. Pro-Line Nissan GTP
5. Parma Bigfoot 6. HPI Ford F-150 7. HPI Dodge Ram 8. HPI CLK GTR
9. Pro-Line Sidewinder GTX 10. Pro Line RAMbunctious GT



R/C INNOVATION MIDNIGHT 2

Not only did you pick the Midnight 2 as the top motor, but you went the whole hog and named it the most innovative product of the year! We can see why. When you take a component that has always been round and lop off the sides to make it "flat," it tends to get your attention!



2. Traxxas EZ Start 3. HPI RS4 MT 4. CVEC Pipe 5. Novak Pit Wizard 6. Sanyo 2000mAh 7. Losi XX4 8. Dynamite Ultra Start w/igniter box 9. Airtronics M8 10. GM ASP

top 10

EDITORS' CHOICE INNOVATIONS

SUPER-NARROW TIRES



I know, you're probably wondering, "Why would the *R/C Car Action* editors choose such a controversial product as one of their top 10 innovations?"

Well, the truth of the matter is that super-narrow tires can improve handling and lower lap times. The tires met with great controversy at the '95 NORRCA Road Course Nationals when Team Yokomo factory driver Masami Hirosaka smoked the competition with a set of prototype hoops. Since then, super-narrow tires have become commercially available from most of the leading tire manufacturers, but they are still not legal in ROAR/IFMAR-sanctioned racing. They are widely used, however, at local club races and have proven to be extremely useful in stock-class racing.

Because super-narrow tires are much lighter than standard narrow tires, they allow touring cars to accelerate and decelerate much quicker. Modified racers can also attest to the benefits of running super-narrows and have earned lap times that are amazingly close to those of direct-drive pan cars.

TOURING-CAR CAPPED TIRES

Capped-tire technology has always been reserved for a select group of high-speed banked oval drivers who race primarily on concrete. Jaco is one of the pioneers of capped-tire racing technology and has now made this technology available to touring-car racers around the globe.

Pro-Line/Jaco's Pre-assembled Sedan Tires offer tremendous performance advantages over the type of tire racers generally assemble themselves. First, instead of using typical foam inserts that can move around or become deformed within the tire, the Jaco engineers use precision-formed foam that is bonded to the contour of the tire's inside diameter and side-walls. The tire and insert are then precision-bonded to the wheel—an attractive yellow Pro-Line Warlock wheel in this case. The completed tire is incredibly true and light and will not flex or expand. These are all benefits that will make your car faster, more stable and extremely predictable. The tires are available in two compounds—Yellow (soft) and Green (medium)—and will fit all Tamiya, HPI, Kyosho and Yokomo kits.



4WD STADIUM TRUCKS

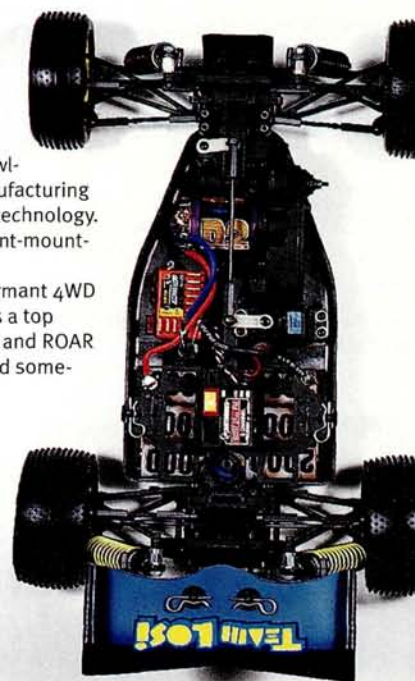
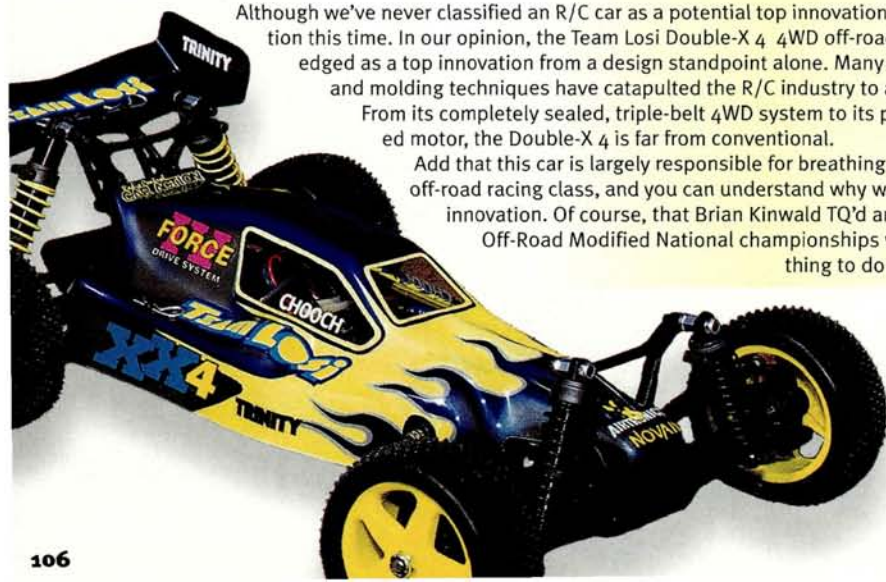
This year, HPI has given us all something to think about—the numerous possibilities for four-wheel-drive stadium trucks. The RS4MT had many followers before its release when it was pictured in *R/C Car Action* as a prototype. The RS4 MT goes anywhere you please—on land, that is—thanks to 4WD. For recreation, these trucks can go from grass to dirt to asphalt and more, but they have racing potential as well. We think a four-wheel-drive truck-racing class could take off just as successfully as two-wheel drive did, especially with the release of Team Losi's truck body for the XX4 buggy chassis. Will 4WD trucks be R/C's Next Big Thing? We'll see!



NEW 4WD TECHNOLOGY

Although we've never classified an R/C car as a potential top innovation, we're making an exception this time. In our opinion, the Team Losi Double-X 4 4WD off-road buggy should be acknowledged as a top innovation from a design standpoint alone. Many believe that modern manufacturing and molding techniques have catapulted the R/C industry to an all-new level of racing technology. From its completely sealed, triple-belt 4WD system to its perfectly balanced mid-front-mounted motor, the Double-X 4 is far from conventional.

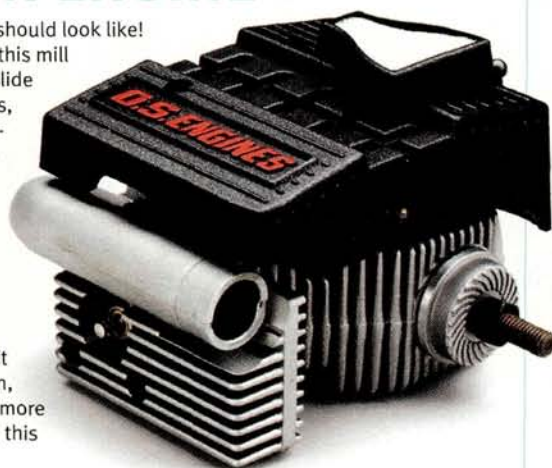
Add that this car is largely responsible for breathing new life into the once dormant 4WD off-road racing class, and you can understand why we chose the Double-X 4 as a top innovation. Of course, that Brian Kinwald TQ'd and won both the NORRCA and ROAR Off-Road Modified National championships with a Double-X 4 also had something to do with it.





LAYDOWN ENGINE

This is what a car engine should look like! However, there's more to this mill than looks alone; with a slide carb, plenty of cooling fins, and O.S.-quality construction, this is a high-performance piece of hardware. We have at last broken free of the stand-up airplane-style powerplants and have an engine specifically designed for cars. Right now, the O.S. .12 LD will fit only the Kyosho Super Ten, but be on the lookout for more vehicles designed around this unique powerplant.



COMPUTER RADIOS



Although the computer radio isn't a new concept, only now are these products truly exploiting all that microprocessor technology has to offer. Today's smart transmitters allow precise control over more features than ever before: ABS, traction control and multi-speed servo operation are just a few of the ways the new radios can help us all be more competitive. Thanks to model memory, a single transmitter can do the job of 10; just store your setups in the radio's memory, and call up the appropriate program when you want to switch cars. Large LCD displays keep the driver well informed on all functions and can even count laps and warn of a low battery. No longer just tools, today's innovative radios are driving partners.

DISCHARGE BOXES

Sure, we all have light bulbs and resistors to dump our packs after a day of racing, but these often do more harm than good; if you get distracted when discharging your battery, you can easily dump the cells to well below their suggested minimum voltage. Smart dischargers that cut off the battery load before voltage drops too low are now common and inexpensive, and over time, they can easily pay for themselves. Newer units such as Tekin's feature-packed DIS-350 can even be linked to a charger and programmed to perform any number of charge/discharge cycles to condition cells, and you can even select your own cutoff voltage and discharge rate.

The addresses of the companies featured here are listed in the Index of Manufacturers on page 217.

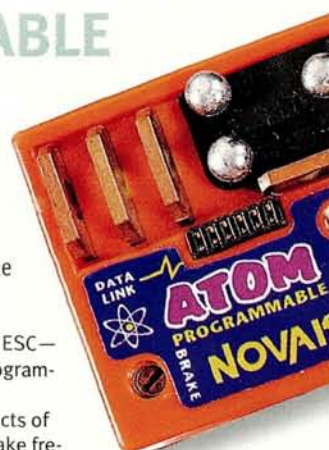
RTR VEHICLES

Time? What time? We're on the move constantly. Who has the extra time to sit down and build a model? Everyone wants to play immediately and avoid the building. This problem had a quick, easy solution—ready-to-run (RTR) vehicles. Many of today's manufacturers offer their cars and trucks in relatively inexpensive pre-assembled kits. Pull the cars out of the box, add batteries or gas, a little paint and a few decals, and go! Oh, some kits are assembled and just require a radio, but the hard building has already been done. Now, if they could come up with a way to have the cars self-clean, then we will have seen it all!

PROGRAMMABLE ESCs

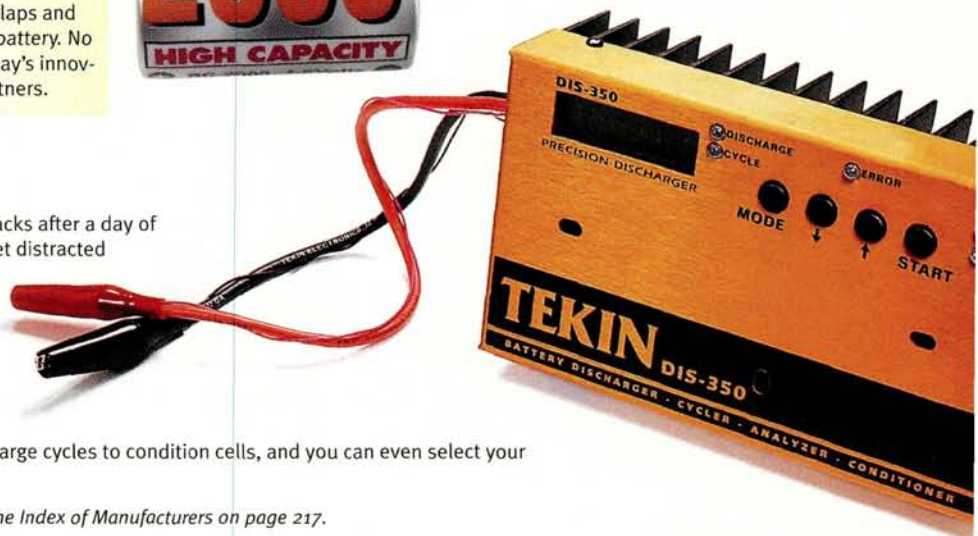
Until very recently, an ESC was something you just couldn't monkey with. You installed it, set it up and left it alone. If you liked the way it worked—great; if you didn't, well, maybe a different brand would have the feel you were after.

Novak changed all that with the Cyclone—the first truly programmable ESC—which has since been joined by the programmable Atom. They're both remarkably adjustable; users may tailor such aspects of performance as the unit's drive and brake frequency, drag brake, deadband, neutral point and more. This is accomplished by means of the Pit Wizard—a handheld programmer that plugs into the Cyclone and Atom—or the PC adapter and software you use with your home computer. Whether your application is 4-cell carpet racing or 4WD buggy racing, the Cyclone and Atom can be programmed to provide the best possible performance and the driving "feel" that's right for you, and that's a real innovation.



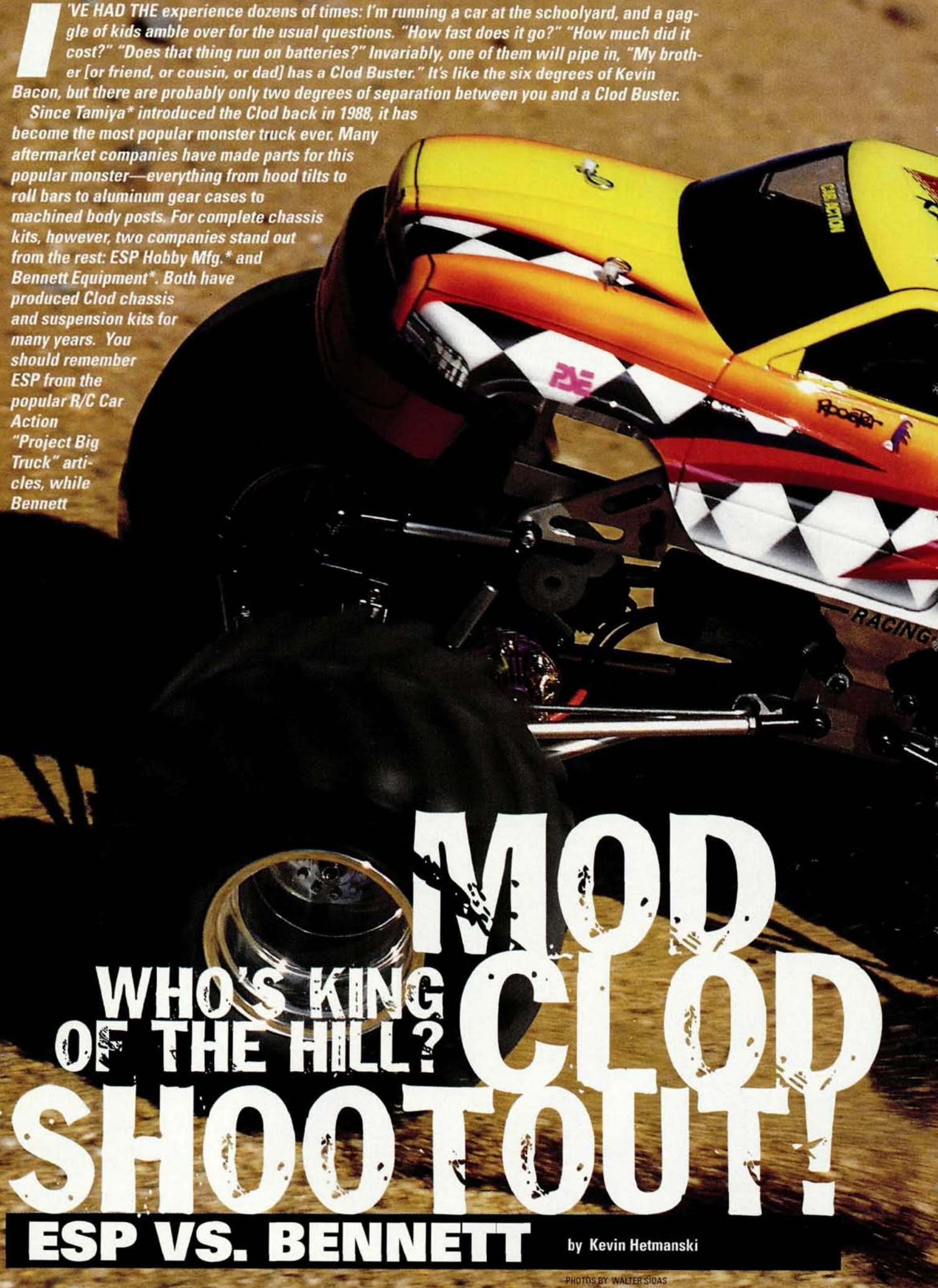
2000mAh BATTERIES

Remember when making run time was an issue? You would be having the run of your life, then, with a minute to go, your car would go into slo-mo. The new 2000mAh cells put an end to all that, not only with increased run times, but also with greater durability and consistency. For racers, the greater capacity allows their cars to be geared for ballistic speed without the risk of dumping in the home stretch, and for enthusiasts, playtime lasts longer than ever.



I'VE HAD THE experience dozens of times: I'm running a car at the schoolyard, and a gaggle of kids amble over for the usual questions. "How fast does it go?" "How much did it cost?" "Does that thing run on batteries?" Invariably, one of them will pipe in, "My brother [or friend, or cousin, or dad] has a Clod Buster." It's like the six degrees of Kevin Bacon, but there are probably only two degrees of separation between you and a Clod Buster.

Since Tamiya* introduced the Clod back in 1988, it has become the most popular monster truck ever. Many aftermarket companies have made parts for this popular monster—everything from hood tilts to roll bars to aluminum gear cases to machined body posts. For complete chassis kits, however, two companies stand out from the rest: ESP Hobby Mfg.* and Bennett Equipment*. Both have produced Clod chassis and suspension kits for many years. You should remember ESP from the popular R/C Car Action "Project Big Truck" articles, while Bennett



MOD WHO'S KING OF THE HILL? SHOOTOUT!

ESP VS. BENNETT

by Kevin Hetmanski

PHOTOS BY WALTER SIDAS



Equipment has many championship titles under its belt. They're both popular, and Car Action has received plenty of requests for a shootout between these two chassis kits; now it's time to deliver.

Starting with a pair of fresh Clods, I built up the Bennett Equipment Clod-A-Leaver IIR chassis and ESP's Clodzilla IV Pro and put them through a series of tough tests to see which chassis kit would rule.

To keep things fair, I set both trucks up with similar gear. Novak provided the Super Rooster reversible speed controls. They can handle dual modified motors (any wind) and have a new feature called Smart Braking, which slows the vehicle to a safe speed before throwing it into reverse. This went a long way toward preventing the trucks from detonating their gearboxes. To supply the big machines with plenty of torque, Pro-Match* supplied killer 17-turn modified motors and 6-cell Sanyo 2000 matched racing packs. I installed Hitec* 605 BB servos to guide these beasts around and over obstacles, and Team Losi* shocks handle the damping.*

Bennett and ESP kits What's the difference?

Despite their apparent similarities, the Clod-A-Leaver IIR and Clodzilla IV are completely different animals. Here's how they stack up:

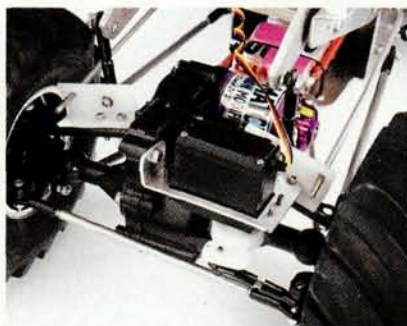


With its radio gear tucked between the chassis sides, the Bennett rig carries a lower CG than the ESP machine.



The Bennett truck's cantilevers are mounted inboard.

Nylon brackets mount the suspension links and serve as carriers for the swaybars.



The Bennett's slab-sided chassis gives it an aggressive, tank-like look.

SUSPENSION

Both trucks feature four-link, cantilevered suspension systems that allow about 1½ inches of shock travel to absorb over 6 inches of suspension action. A close inspection of the cantilever (the triangular, pivoting bracket to which the shock is attached) reveals how this is possible: the pivot for the aluminum suspension link,

which is joined to the axle, is much farther from the cantilever's fulcrum than the shock pivot is. Thus, the arc described by the shock's pivot point as the cantilever goes through its range of motion is much smaller than the arc of the link's pivot—a simple and ingenious system that allows a (relatively) small shock to do a big job.

Although their suspensions are identical in function, their means of construction differ.

■ **Bennett**—cantilevers pivot on plastic bushings; L-section nylon brackets are used to join the solid stainless-steel suspension links to the axles.

■ **ESP**—cantilevers feature ball bearings. The ESP's links are attached to similar brackets made of aluminum.

On both kits, the brackets also support the front and rear swaybars:

■ **Bennett**—feeds the swaybar ends through the nylon brackets on the axles and uses nylon bushings at the chassis.

■ **ESP**—uses pivot balls captured by rod ends to hold the swaybars at the axles, and rubber grommets hold the swaybars at the chassis. The trucks' four-link systems are also made of different materials:

■ **Bennett**—stronger, but heavier, stainless steel threaded for 6-32 links.

■ **ESP**—aluminum tubular links with 6-32 replaceable studs.



STEERING

■ **Bennett**—two-wheel steering (2WS). To make this work, the front hubs' steering stops have been removed to allow greater hub throw. This is required because the unsteered rear wheels would otherwise limit the truck's turning radius. Slight modifications are required to fit the servo mount on the front gearbox, but the changes are minor. The steering servo is mounted directly over the tie rod, eliminating the stock servo-saver and the link that joins it to the servo.

■ **ESP**—four-wheel steering (4WS); two servos, one mounted on the front gear case and the other on the rear. The servos are fixed to L-section aluminum mounts that are attached to the gearbox using the existing motor screws. The front servo uses a large servo-saver and the rear uses a small one; this gives the rear wheels a smaller turning radius than the fronts and gives a more stable feel to the truck's handling.



ESP's nicely finished cantilevers pivot on ball bearings and are relieved for lightness.



Aluminum links with replaceable 6-56 studs are used throughout the suspension system.



The ESP's radio tray is flush with the chassis' top rails, giving the truck a CG that's slightly higher than the Bennett machine's.

CHASSIS

■ **Bennett**—made of 5052 sheet aluminum that has been cut and bent to shape, configured as left and right halves. The halves are joined with square aluminum stock, and the battery tray is then bolted to the assembly. The radio gear is fixed to a plate that rides low between the sides of the chassis to reduce the vehicle's center of gravity. Bennett warrants all parts against defects in materials and manufacturing.

■ **ESP**—uses many types of aluminum stock. The upper chassis features C-channel aluminum rails connected in a ladder configuration by round stock. Two pieces of sheet aluminum fixed to the rails hold the bottom tray/battery holder, and another piece of sheet stock bridges the chassis rails to form a platform for the radio gear. ESP uses 6061 aluminum for its kit, and heat treats the alloy to T6 hardness. All parts are warranted for life against breakage and are clear-anodized for better finish and to protect them against oxidation.



The completed rolling chassis is one high-tech-looking machine. A clear-anodized finish helps the good looks last.

STOCK TRUCK VS. MOD KIT

The Bennett and ESP racing kits improve the Clod Buster in many ways. Here are the highlights:

Suspension systems are much improved over stock. Cantilevered, "four-link" designs suspend the Clod's rigid axles. The links extend from the axles to the main chassis. There are two links per hub, and, thus, four links per axle—hence the name.

Out of the box, the kit Clod has less than 1 inch of single-wheel travel before the main chassis bottoms out on the gearbox, and the suspension action is stiff. With the installation of the racing chassis kits, suspension travel is increased to over 6 inches. As a demonstration, it is possible to place a wheel on top of a soda can without any of the other tires lifting off the ground. The four-link system also offers a little bit of adjustment; the wheelbase can be altered slightly, and the angle of the gearboxes may be adjusted subtly to change the truck's steering characteristics.

Steering systems are also much better on the aftermarket chassis. The stock Clod uses one servo to turn all four giant tires; suffice it to say, this can be hard on a servo. To facilitate 4WS, the ESP and Bennett kits may use an individual servo for each pair of wheels, or a single servo may be used for conventional two-wheel control. Both configurations use control linkages that are much beefier than stock, which reduces flex and increases steering precision.

Esthetics no small concern in monster trucking circles. Neither chassis disappoints. Both kits offer exciting real-truck looks and are made of aluminum for high strength and low weight. The completed machines have a much leaner, meaner look than the stock Clod with its chunky, plastic chassis tub.



Let the games begin!

ESTHETICS

I promise the rest of the tests are less subjective! I think the ESP chassis wins this category hands down because it looks more realistic than the Bennett truck and has a highly polished finish. I also liked the ESP's outboard shock design, which allows you to see the suspension in action more easily. To me, the Bennett rig has a more purely functional look—not a bad thing at all, but for sheer glitz, I give the nod to ESP.

■ Winner: ESP

SUSPENSION TRAVEL

You've gotta have a whole bunch of suspension action to keep a monster truck on all fours. In addition to total suspension travel from full extension to full compression, I also measured how much single-wheel travel each truck was capable of.

To do this, I lifted the right front wheel until the right rear tire started to leave the ground. At this point, I measured from the ground to the bottom of the raised tire. In the single-wheel test, ESP blew Bennett away with a whopping 10½ inches of travel compared with Bennett's 7½ inches. The Clodzilla IV also bested the Clod-A-Leaver IIR in total suspension travel, but by only the smallest margin—⅛ inch, to be exact.

Single-wheel travel:

ESP 10.5 in.; Bennett 7.5 in.

Total travel: ESP 2.5 in.; Bennett 2.375 in.

■ Winner: ESP

GROUND CLEARANCE

I measured this as the distance from the ground to the bottom of the lowest point on the main chassis. The greater the ground clearance, the more gnarly the terrain can be before it stops the truck. Built according to the manufacturers' instructions, the mod monsters show quite a difference. The ESP had 4½ inches of ground clearance while the Bennett provides 3 inches.

I think this represents a bit of a philosophical difference between ESP and Bennett; I'm not surprised that Bennett, the reigning NR/CTPA champ, would have such a racy, low design while the "crush 'em all" ESP has the taller, rough-terrain-friendly design.

■ Winner: ESP

ROADCOURSE HANDLING

For this test, we headed to my favorite race place, R/C Madness in Enfield, CT, where owner Chris Marcy set up the carpet track just for the monsters. Now, I know you're thinking "Monster trucks on carpet?," but this is how the National R/C Truck Pulling Association does it.

Chris designed a killer track with plenty of turns. Just like an NR/CTPA track, it had jumps and moguls (plow disks, actually). We recorded lap times with the track's transponder system and programmed the computer-timing system for 2-minute heats.

In this test, I thought that the trucks would be very close but, boy, was I wrong! The ESP truck was a bit of a handful; its 4WS was very touchy, and that made it difficult to maneuver around the track.

The Bennett truck was a completely different story. It handled the twisting track like a sedan (well, kinda like a sedan).

The Bennett machine was obviously the better handler, but I felt I should run the test again with the ESP's rear steering locked out. After this modification, the results were much closer. With the ESP in modified trim, I'd call it a tie, but out of the box, built according to the manufacturer's instructions, the Bennett comes out on top.

Best finish in a 2-minute race:

Bennett—6 laps, 2:13.24 minutes.

ESP—4 laps, 2:13.39.

■ Winner: Bennett

WEIGHT

The kits were weighed with nearly all the running gear installed. I left out the receivers because they were the only components the trucks didn't share, and I didn't want the truck with the heavier receiver to be disadvantaged, however slightly. It should be noted that the ESP truck was weighed with two servos, as required by the stock four-wheel steering system. Without the extra servo, the ESP machine actually weighs 1 ounce less than the Bennett. But once again, that extra servo is required to run the ESP in stock trim, and stock trim is what counts for these tests.

Weight:

Bennett—8 lb., 6 oz.

ESP—8 lb., 9.5 oz.

■ Winner: Bennett

KICK-ASSS PRICES !!

Authorized Sanyo Distributor

SANYO Single Cells (w/o tabs)

Model #	1.2V/MAH	DxH(mm)	WT(g)	Sale
N-50AAA	50	10.0 x 15.0	3.5	\$2.00
N-110AA	110	14.0 x 16.5	8	2.00
N-600AA	600	14.0 x 49.5	24	1.60
KR-800AAE	800	14.0 x 50.0	28	2.50
KR-1100AAU	1100	14.0 x 50.0	27	3.00
N-225AE	225	16.5 x 16.3	12	3.00
KR-600AE	600	16.5 x 27.8	22	2.25
N-1000SCR	1000	22.0 x 33.0	39	4.20
KR-1300SC	1300	22.0 x 42.0	48	2.80
N-1400SCR	1400	22.0 x 42.0	52	4.20
RC-1700	1700	22.0 x 42.0	54	4.50
N-1700SCRC	1700	22.0 x 42.0	55	5.00
RC-2000	2000	22.0 x 42.0	58	7.00

Please add \$0.20 per single cell with Solder Tabs

SANYO Power Packs (Flat or Hump)

Model#	V/MAH	LxWxT(mm)	Sale
8N-600AA-4(TYCO)	9.6V/600	102 x 56 x 14	18.00
6N-1500SC(Sports Pack)	7.2V/1500	135 x 46 x 23	15.00
6N-1400SCR	7.2V/1400	135 x 46 x 23	28.00
7N-1400SCR	8.4V/1400	150 x 46 x 23	32.00
6RC-1700	7.2V/1700	135 x 46 x 23	31.00
7RC-1700	8.4V/1700	150 x 46 x 23	36.00
6N-1700SCRC	7.2V/1700	135 x 46 x 23	34.00
7N-1700SCRC	8.4V/1700	150 x 46 x 23	39.50
6RC-20000	7.2V/2000	135 x 46 x 23	45.99
7RC-20000	8.4V/2000	150 x 46 x 23	53.50

Tamiya Conn. comes standard with all Power Packs

SANYO Packs For Radio (Flat or Sqr.)

Model#	V/MAH	LxWxT(mm)	Sale
4N-225AE	4.8V/225	67 x 17 x 17	12.00
4N-600AA	4.8V/600	56 x 50 x 14	9.00
4KR-600AE	4.8V/600	67 x 28 x 17	12.00
5N-600AA	6.0V/600	70 x 50 x 14	11.00
5KR-600AE	6.0V/600	83 x 28 x 17	12.00
8N-600AA-1	9.6V/600	100 x 29 x 29 (w/wire)	18.00
8N-600AA-3	10.2V/600	116 x 50 x 14 (w/wire)	18.00

* Add \$4.00 to Connect Specific Radio Connector

* Call us if you can not find your Sanyopack on this list.

AIRTRONICS

MODEL #	DESCRIPTION	SALE
94145	Precision Micro coreless BB (33oz/.07sec)	53.99
94102	Precision heavy duty (50oz/.22sec)	12.99
94322	Precision heavy duty BB (50oz/.20)	16.95
94157	Pro RR hi-speed aluminum coreless (95oz)	89.99
94158	Pro RR hi-torque aluminum coreless (130oz)	89.99
94737	Contest Hi-speed coreless BB (57oz/.15sec)	54.99
94738	Contest Hi-torque coreless BB (71oz/.21sec)	54.99
94742	Contest GP Hi-speed BB (50oz/.11sec)	39.99
90137AM	Rival Sport - RV2PS/102(1)	50.99
90280FM	M-8 - 102(2) - in "Z" connector only	339.99

* Call us if you can not find your Airtronics item on this list.

* Please specify "Z" or "Airtronics" connector on your SERVO

hitec (Servos & Radio systems)

MODEL #	DESCRIPTION	SALE
HS-85BB	Mighty Micro Servo wtop BB (38oz)	32.95
HS-205-BB	Super Mini Low Profile Servo (42oz)	27.55
HS-300	Stuper Sport Servo (42oz)	10.95
HS-425BB	Pro Servo with Dual Ball Bearing(43oz)	18.95
HS-605BB	Ultra Torque Servo (77oz)	36.95
HS-605MG	Ultra Torq. Servo (all metal gear)	46.55
HS-615MG	Super Torq. (metal gear - 107oz)	46.55
HS-700BB	Giant Scale Servo (133oz)	29.55
Shredder Rx	Micro Shredder Receiver (all brands - 75mHz)	31.95
RXT0475	75mHz AM single conv. Tx & Rx set	8.50
HRS0475AM	Lynx AM (75mHz) Radio System	59.95

* Call us if you can not find your Hitec item on this list.

* Please specify the desired connector on your Hitec unit.

Gold Plate Connectors

Male servo lead 12"	2.50	
Male battery lead 12"	2.50	
Female 3 wire 12"	2.75	
Female 2 wire 12"	2.75	
Extension 6"	4.00	
Extension 12"	4.50	
Switch w/harder wired	8.00	
Exchange adaptors (servo-rx)	4.00	
JST (BEC) male / female set	4.00	

Extensions

Y-Adapters (1 Male/ 2 Female)

* Available for Futaba J, Futaba G, JR, Airtronics, Hitec, World-Eng.
 * Prices Effective 1-1-98 and subject to change without notice
 * Visa & Master card accepted (S & H is \$5.99)
 * S & H is \$5.99 and UPS Cod Cash is \$5.99 for any size order
 * All returns subject to inspection and 15% restocking fee

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MOD CLOD SHOOTOUT

CENTER OF GRAVITY

Anyone who knows racing knows how important it is for your vehicle to have a low center of gravity (CG). A lower CG allows quicker handling and, at the limits, decreases the likelihood that your vehicle will flip over.

I tested the trucks by placing them both on a flat board that I tilted gradually until one rolled over. I tested the trucks both at full ride height and with the suspensions fully compressed. In both tests, the ESP was the first to tip, probably because its electronics are mounted higher than the Bennett's.

■ Winner: Bennett

TURNING RADIUS

Given its 4WS, I figured the ESP truck would have a big advantage here, and I was correct; it carved out a turn in just about 1 foot less space than the Bennett. With its optional rear steering-servo mount, the Bennett truck would match the ESP but, as noted before, it's stock equipment that counts for my tests.

Turning radiuses:

Bennett—116 1/2 inches

ESP—103 1/2 inches

■ Winner: ESP

JUMPING ABILITY

This had to be the coolest test; there's nothing I enjoy more than sending huge monster trucks sailing through the air.

I built a 2-foot-high plywood jump and launched the monsters off it at full speed. The Bennett truck worked very well here; it soaked up the truck's sprung weight very efficiently. This is important for racing; the faster the truck settles, the faster it can get back on the gas. The ESP truck felt a bit less supple on landing and tended to get out of shape as it rebounded. With a little tuning time, I'm sure the ESP would improve, but the Clod-A-Leaver wins out of the box.

■ Winner: Bennett

FULL-SPEED TURNING

I tried very hard to get these trucks to roll over, but to no avail. Both were given a full charge to be sure they would reach warp speed. Even at full tilt, neither flipped, no matter how hard I sawed at the wheel. Although both main chassis listed under hard cornering, all four wheels stayed planted.

■ Winner: tie

DURABILITY

ESP's Clodzilla IV is built of a stronger grade of aluminum than the Clod-A-Leaver IIR but uses tubular aluminum ladder bars, while the Bennett uses stainless-steel bars.

My tests didn't come close to denting either machine, however. Neither rig suffered any damage during my tests, so a tie it is.

■ Winner: tie

BACKYARD BASH

Although the individual performance tests are telling, they say nothing of the general driving experience. To test the "fun factor," I spent a lazy afternoon chugging through the grab-bag terrain of a vacant lot.

The machines were equally adept at handling all manner of crumbled asphalt, dirt, sand, roots, rocks and debris. The ESP did have an advantage, however, by virtue of its greater ground clearance. On the really big stuff, the lower Bennett rig would high-center itself and occasionally required a helping hand to get off obstacles. The taller ESP often cleared the same obstacles.

■ Winner: ESP



AND THE WINNER IS ...

So which comes out on top? If we award a point for each win and no points for a tie, these machines come out dead even! However, if you apply certain conditions to your decision-making, the choice becomes more clear. If you plan to do some monster-class racing, I suggest the Bennett Clod-A-Leaver IIR. It is very stable, has a low center of gravity to help it stay on all fours and boasts a record of winning NR/CTPA championship events. For fooling around in the backyard, I'd say the ESP Clodzilla IV has the advantage. Its high ground clearance and amazing suspension travel help it to maneuver over almost any obstacle, and it looks great while it's doing it.

No matter which kit you choose, your Clod Buster will enter a whole new realm of high performance, durability, scale looks and driving excitement.

*Addresses are listed alphabetically in the Index of Manufacturers on page 217.

PIT Wizardry

by Peter Vieira



DIALING IN THE NOVAH ATOM AND CYCLONE

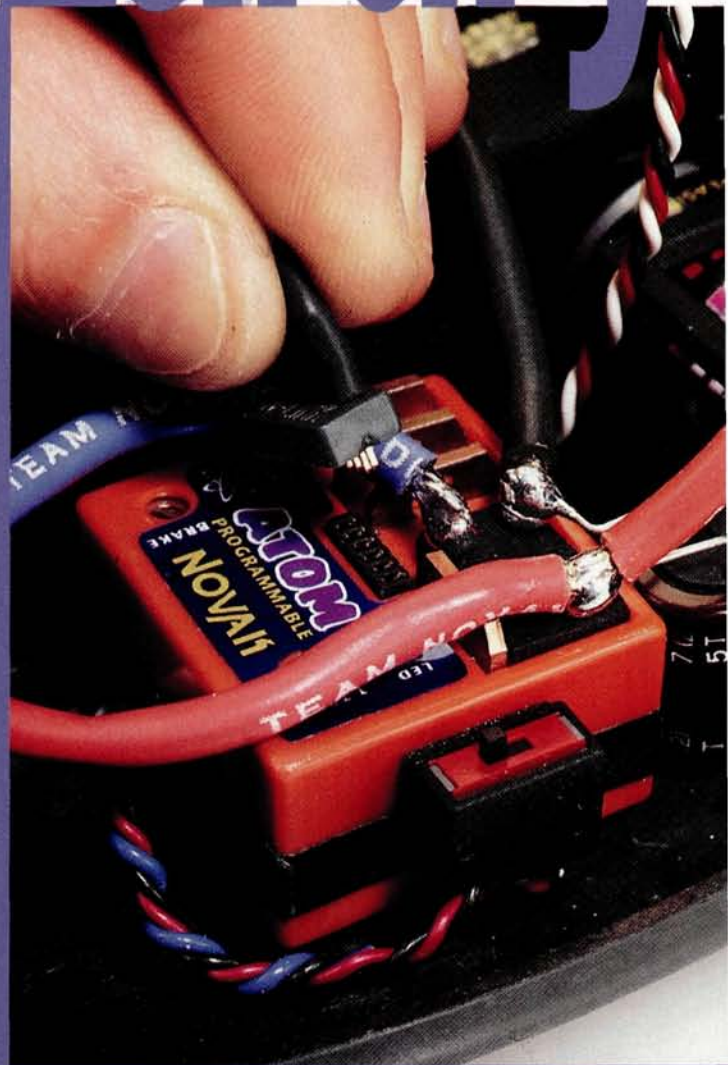


IN RACING, adjustability is everything. On the typical race-car—on- or off-road—nearly every aspect can be adjusted: caster, camber and toe-in at the wheels; shock position, damping and spring pre-load for the suspension; battery placement, wheelbase and track for the chassis—just to name a few of the possibilities.

The electronics of the modern racer have been given much less attention in terms of adjustable features. The electronic speed control, in particular, has traditionally been quite rigid in its operation; aside from matching the ESC to the radio so that forward and reverse match the trigger throw and perhaps the occasional current-limiter tweak, ESCs are largely forgotten once installed.

Novak* changed all that with the introduction of its Cyclone speed control in 1996. While the Cyclone's performance and small size were groundbreaking, the real buzz was about its adjustability. Sure, you could choose one of three pre-programmed "profiles" to suit your driving application, but it was the hidden fourth profile that represented the Cyclone's *raison d'être*: this was a profile *you* could program to match your driving style and needs. By simply plugging Novak's Pit Wizard (PW) hand-held programmer or the PC interface hardware into the Cyclone, you can, in minutes, create your own operating profile. Once only possible in the realm of lab-coated technicians, now any racer worth his decal collection can design his own ESC.

Like any new frontier, the vast possibilities of a programmable ESC also brought a whole universe of questions. Which parameter to adjust when? And how? Is it better to adjust the car or the ESC?—or the radio? We know how you feel, and we're here to help. This is your guide to programming the Cyclone and its new little brother, the Atom. Even if you don't own one of these units, the information herein will help you understand the specs—however fixed—of your own ESC.



UNDERSTANDING THE ADJUSTABLE PARAMETERS

Once the Pit Wizard has uploaded a profile, we can begin playing with the numbers. The only settings you probably won't want to monkey with are neutral, full throttle and full brake. These settings are collected by the Cyclone directly from your radio; as long as you don't change them, any profiles you create with these settings will automatically match that radio's output for neutral, full throttle and full brake. So why change 'em? Novak offers the example of drag racing, where you might want to create a "hair-trigger" profile by lowering the value for full throttle, thus decreasing the trigger travel required to reach full throttle. You might also change the values to match a new radio that would not otherwise correspond with the profile's settings (see section, "Transmitter Check-Out"). In most applications, however, the settings should not be changed.

Basic editing technique

To change parameters, simply hit "mode" until you reach the Edit Profile screen, then hit enter. You may now use the up and down keys to cycle through all 10 adjustable parameters: neutral, full throttle, full brake, deadband, drive frequency, minimum drive, brake frequency, drag brake value and toggle option. When you reach the parameter you wish to adjust, hit enter, use the up and down keys to increase or decrease the value, then hit

enter again to lock it in. Here's how each parameter affects the operation of the Cyclone and Atom:

Neutral, full throttle, full brake

These functions really shouldn't be altered, as they affect the location of each function within the trigger throw. There are few applications where you would not want neutral, full throttle and full brake to line up with the trigger's neutral, full-throttle and full-brake positions. If you do wish to alter these functions, however, lowering the value for full brake and full throttle will bring them closer to neutral; move the trigger less to activate them. Raising the neutral value will move the neutral setting into the throttle portion of the trigger throw, and lowering the value will move neutral to the brake portion of the trigger throw.

Deadband

No matter which type of ESC you have, you'll notice that there is a little trigger travel



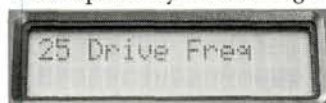
that does not activate the ESC. This area is called the deadband. The PW allows you to adjust the size of this area and indicates it as a percentage of total trigger throw. Any changes made here will affect both the throttle and brake side of the trigger's travel; to use Novak's example, adding 10 percent to the deadband will add 5 percent more deadband to the throttle side of

neutral and 5 percent more deadband to the brake side of neutral.

• **What it affects:** adjusting the deadband to a higher percentage can help prevent less precise drivers from activating the throttle or brake unnecessarily, and in some cases may also be used to compensate for sloppy trigger action. Lowering the percentage of deadband can help skilled drivers transition from forward to brake more quickly and achieve faster starts.

Drive PWM Frequency

To oversimplify, an ESC regulates speed by switching a



car's motor on and off many times each second. The number of on/off cycles each second is the units frequency, measured in hertz (Hz). If you were to flip a switch on and off once per second, the switch would be operating at 1Hz. The Cyclone and Atom can be programmed to operate at frequencies as high as 23.4 kilohertz—that's equal to 23,400Hz—or as low as 122Hz. The Pit Wizard adjusts the frequency to one of 16 preset values, including these two extremes.

• **What it affects:** increasing the drive frequency will tend to make the ESC's output feel smoother and more linear, but the ESC will require more trigger movement from the radio to initiate movement of

Programming POWER



the car. Decreasing the drive frequency has the opposite effect, resulting in a punchier throttle feel. Frequency adjustments can help a car cope with slippery surfaces (use higher frequency) or take advantage of high-traction, high-speed tracks (lower frequency). The highest frequencies tend to be most beneficial to racers who need very precise control over light vehicles—think 4-cell, on-road 1/12 racing. The lowest frequencies are best suited to applications such as drag racing, where the quickest trip to full throttle is



Like us, you've probably spotted quite a few Cyclones in the winners' circle since the popular ESC hit the streets. We asked some notable Cyclone users for their programming notes and tips.

Kirby Hand, Team Trinity

Kirby uploaded the Oval Nats-winning setups from his Switchblade 10SS and Switchblade 12 for us. "I start out with profile 3, then make changes from there."

1/10 mod setup	Deadband 2%	Drive PWM frequency 11.4kHz	Minimum drive 4%	All other values the same as profile 3
1/12 mod setup	Deadband 3%	Drive PWM frequency 15.6kHz	Minimum drive 2%	All other values the same as profile 3

"I like to make frequency and deadband changes to tune the car and use them to make it feel as though it has a bigger power band. The Pit Wizard is definitely an advantage; you can make changes right on the track. Just plug it in."

what really matters. Other aspects to be considered are vehicle weight and motor selection; these will also affect your frequency choices. The Pit Wizard makes it very easy to experiment, and that's the best way to make your decision.

Minimum Drive

This adjustment determines how much throttle will be applied to the motor as the ESC's lowest possible "speed." The Pit Wizard indicates minimum drive as a percentage of full throttle and can be set as



low as 0 percent or as high as 50 percent; for example, a setting of 50 percent means the throttle would be off with the trigger at rest, then jump right to 50 percent throttle the second the trigger reaches the end of the deadband.

- **What it affects:** the lowest minimum drive settings allow very fine control of light vehicles such as 1/12 cars, allowing you to roll on the throttle very smoothly from a standstill. Heavy, horsepower-intensive machines like racing trucks do not benefit from low minimum drive settings because they simply do not move until the motor receives a certain dose of power. However, lowering the minimum drive can help any vehicle in low-traction conditions and may be used to take some of the edge off torquier motors. Again, experimentation is key; that's why these tools exist.

Minimum Brake

Like minimum drive, this setting determines the smallest amount of braking force the ESC will apply when the brakes are activated. This function is actually adjusted directly on the Cyclone and Atom via a

pot (see the special section "Dialing in drag brakes" for the full scoop on the Pit Wizard connection).

Brake PWM Frequency

In the same way as the drive frequency is adjustable, so,

too, is the brake frequency. The same 122Hz to 23.4kHz adjustment range is available, and changes affect brake action in a similar way to the effect of drive frequency on throttle.

- **What it affects:** brake-fre-



Dialing in Drag Brakes

Both the Cyclone and the Atom have an impressive drag-brake system that is highly tunable. Properly exploited, this system can make a big dent in your lap times by applying exactly the same amount of brake each time you let off the gas. Unlike the Cyclone's and Atom's other adjustable parameters, which are simply increased or decreased in value to change their settings, the drag-brake feature requires that you make some additional decisions.

DRAG-BRAKE VALUE

As its name implies, this setting will cause the brakes to "drag" when the car is coasting; when



the transmitter's trigger is in its neutral position, the brakes

are applied. The drag-brake value determines just how much brake will be applied; the Pit Wizard shows this value as a percentage of full braking power and adjustable from 0 to 50 percent.

- **What it affects:** gas racers have used drag brakes for years, but there has always been a liability to their use in ESC-equipped vehicles. Racers would dial back their throttle trim so that "neutral" would be in the brake portion of the ESC's operating range. This did create drag brakes, but when transitioning back to forward throttle, it took significant trigger travel to pull through the drag-brake area and reactivate the throttle. The Cyclone and Atom avoid this because the neutral (deadband) area isn't changed. The instant you move that trigger off neutral, you're on the gas, no matter what the drag-brake setting is.

DRAG-BRAKE TOGGLE

There's more to this drag-brake business. Drag-brake toggle is a digital switch within the Cyclone



and Atom that determines how the unit's brake pot

will be used. The Pit Wizard will tell the ESC whether to activate the switch according to your input at the Toggle Option screen. When you hit enter, the screen will read "Toggle Select" and display eight zeros, each representing a switch (zero equals "off"; 1 equals "on"). Only the first toggle from the left is active; the rest are for future use. The toggle on the far left is activated by pressing enter, which changes the 0 to 1. If the toggle is off,

the ESC's brake pot adjusts the minimum brake value, and the Pit Wizard can be used to adjust the drag-brake value (the value must be greater than zero to activate the drag brake). This allows you to set the minimum brake higher or lower than the drag-brake setting.

If the toggle is switched on, the ESC's brake pot adjusts the drag-brake value at the brake frequency, and this valve also serves as the setting for minimum brake. The Pit Wizard cannot be used to alter the drag-brake value if the toggle is on, and the ESC will not recognize a programmed drag-brake value.

DRAG-BRAKE FREQUENCY

This is also toggle-sensitive. With the Pit Wizard, if the toggle is off, the drag-brake frequency may be adjusted independently of the brake PWM frequency. If



the toggle is on, the brake-PWM-frequency setting will also be your drag-brake-frequency setting. See "Brake PWM Frequency" in the section titled "Understanding the Adjustable Parameters" for the "skinny" on adjusting brake frequency.

The drag-brake options may seem like a lot to consider, but using the function is easier to do than it is to read about. Many racers find it convenient to leave the toggle on and use the pot to adjust drag brake; they can coast into a corner to check the drag brakes, then pull the car up track-side and twist the pot for quick-and-dirty adjustments until they find the perfect setting. Operating in this mode, the amount of drag brake also serves as the amount of minimum brake, which is usually fine. By switching the toggle off, racers can digitally adjust the drag-brake value and easily revert to a previous setting; it is more accurate to punch in a number with the Pit Wizard than to use the pot on the ESC.



Brian Kinwald, Team Trinity/Losi

Brian gave us his all-purpose blue-groove setup, which he uses for all off-road classes—truck, buggy and four-wheel.

"I'll change my brake frequency depending on the track conditions, but I don't jump very far from my basic setup. I'll also change my minimum drive value, depending on my motor choice; I'll use less minimum drive for a hotter wind."

Deadband 1 to 2%	Drive PWM frequency 11.7kHz	Brake PWM frequency 11.7kHz	Minimum drive 2 to 3%	Drag-brake frequency 23.4kHz
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accomplished by uploading the data directly from the Cyclone or Atom. It's easy to do; just turn all your gear on, plug the PW into the Cyclone, hit the Mode key until you see Upload Data, then hit enter. The PW will read "Done" a split second later. In this case, I've uploaded Profile 1 from the Cyclone in my buggy. In addition to the data regarding this profile's settings for drive and brake frequency, dead-band, minimum drive, etc., the PW also collects the neutral, full-throttle and full-brake data "learned" by the Cyclone during the one-touch setup procedure. This information will be passed along to

the new profile so you won't have to reset the Cyclone after loading the profile.

I don't have any changes in mind yet, so I'll file the data away in the PW's memory. I simply mode over to Save Profile, hit enter, use the up and down keys to pick the memory location I wish to assign the profile to, then hit enter (the PW can't name the profiles, so it's wise to keep notes on which profiles are stored in the memory locations; the PW's manual includes blank data sheets just for this purpose). I'll store the profile in memory location "0."

Now I can head to the track and test the car. If I

decide to alter the profile, I already have it stored in the PW. To access it, I just mode over to Read Profile, hit enter, use the up and down keys to select the memory location number of the profile I wish to edit, then hit enter again. The profile is now available for editing by entering the Edit Profile menu. I can key in my changes, save them in memory location "1" and download the new profile into the ESC. If I want to go back to the profile I stored in memory location "0," I can just download it from the PW. If the setup works but I want to try improving it, I can make some changes and save

the altered setup in memory location "2," keeping the profile in location "1" available in case my changes muck things up. The PW will store up to 10 profiles, so you can experiment endlessly.

As with chassis changes, it's best to change one parameter at a time. However, the PW allows you greater freedom to experiment because you can always reload your favorite profile. Once I have my car sorted out, I like to try some really off-the-wall stuff, just to see how it works. I can keep what I like, or junk the whole thing and go back to my track-tested profile.

Who comes up with this stuff?

Innovative products like the Cyclone, Atom and Pit Wizard don't just happen. It takes a lot of creativity, foresight and sheer brain power to take an idea from initial concept to design to final production. Adnan Khan, Novak's engineering manager, is the cornerstone of Novak's product development team and has talents that reach far beyond the R/C world. Adnan holds a B.S. in engineering from Northrop University and has 16 years' experience in the electronic systems and integrated circuit (IC) design industry. Before joining Novak in 1989, Adnan held the positions of applications engineer at GE Semiconductors and Harris Semiconductors and was a design engineer at Fairchild Semiconductors. Adnan designed the hardware for the Cyclone, Atom and Pit Wizard and also wrote the software for these products. He also designed the first custom digital IC for the Novak MEGAFET series of speed controls and has written several articles that have been published in *Electronic Design News* magazine—a leading publication in the electronic industry.

R/C Car Action: Which types of projects were you involved with before you joined Novak?

Adnan Khan: Most of the projects I worked on before joining Novak Electronics were related to the aerospace or defense industry. Working in the semiconductor industry, you get involved with many different end users of integrated circuits. Many of the circuits we worked with are used in radar or missile-guidance systems and performed signal-processing functions. All these circuits operated at very high speed. One circuit that I remember is the radar-jamming system used in the Air Force bomber. We helped by reducing the size of a black box, which was approximately one cubic foot, to an enclosure the size of a pack of cigarettes, and at the same time, improved the operating speed by a factor of two. The company I worked for developed several ICs that were equivalent to tens of thousands of transistors each. With these chips, the end system could fit into the small space and consume much lower power.

As an applications engineer for GE Semiconductor, I was involved with the development of the rugged MOSFETs. These were used in high-power systems like the AM radio-broadcast transmitters, anti-missile gun servo system and large industrial motor controllers. GE developed these very rugged MOSFETs that could stand extremely brutal conditions. I have applied much of that knowledge learned to Novak Electronics' speed controllers to improve their reliability and ruggedness.

RCCA: Wow! That's a far cry from R/C cars! How did you get involved with Novak?

AK: In 1988, Novak Electronics were looking to develop their own custom chip for high-frequency speed controllers, and they picked GE Semiconductor to build the chip. I was assigned the job of designing that chip, and I worked closely with Bob Novak on that project. Bob

gave me all the functional requirements for the speed controller IC, and I did all the logic design and the chip layout. After the chip design was done, Bob asked me to join Novak Electronics, and the rest is history.

RCCA: Are ESCs a piece of cake for you, or are there unique problems that are difficult to solve?

AK: Most basic speed controllers would be no problem. I redesigned the custom digital chip for our entry-level speed controller Explorer in '95, and it only took me a couple of weeks to design and lay out the chip.

I have designed many new features, such as One-Touch Set-Up, Radio Priority Circuit and Polar Drive Circuit. These types of circuits are much harder to implement the first time, like we did. Every new speed controller that I designed has many of the new features, which present a new set of challenges.

The Cyclone ESC was a very big challenge. Not only did I have to design a small speed controller, but I also designed in a host of new features. To take full advantage of all these new features, I also had to design Pit Wizard and the Data Link. The software for the Cyclone took almost six months of solid work and the Pit Wizard another six months. Most of the software in our ESC works in real time; this type of software is much harder to develop and debug. What I mean by that is, as the information is coming to the speed control from the receiver, the speed controller reads that information and calculates and decides what to do with it in real time. Information from the transmitter is updated every 20mS. Software in the Cyclone and Atom ESC only requires approximately 500uS, worst case, to process that information and output the proper response.

**Addresses are listed alphabetically in the Index of Manufacturers on page 217.*

GET UP TO SPEED WITH ...

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In this month's "Racer News," we talk with MIP's Eustace Moore. MIP CVDs are very popular among serious racers around the globe, but few people are aware of what goes on behind the scenes at MIP. Here's your chance to become better acquainted with this innovative company.

Team Schumacher factory driver Jukka Steenari stirred up the racing world when he finished in second place in 4WD at the IFMAR Off-Road World Championships. This

hot new driver recently made headlines by announcing his intentions to race Team Losi vehicles while continuing to use Team Orion batteries. We chatted with Steenari not long ago and found he had some interesting things to say. Be sure to catch this month's "Racer Profile."

You'll find some hot new products in our latest installment of "Speed Shop," as well as a racer tip from multiple-world-championship winner Masami Hirotsuka, so prepare to shift into high gear.

INNOVATOR AT WORK

EUSTACE MOORE

Moore's Ideal Products

(MIP) has been providing racers with high-quality products for nearly two decades. Their popular CVDs are found on just about every national and world championship-winning car and truck and appear to have become America's hop-up of choice. In fact, many manufacturers now include MIP CVDs in their kits. We recently had the pleasure of touring MIP's brand-new facility in Covina, CA, and spending an afternoon with company owner Eustace Moore and his general manager, Sue Christensen. The following interview took place during that visit.

R/C Car Action: First of all, Eustace, thank you for your hospitality, and congratulations on the launch of your brand-new headquarters. I think our readers would be very interested to learn a little more about how MIP started, as well as some of the company's future plans. How and when did you first become involved in R/C?

Eustace Moore: From the age of five, I dreamed of playing with toys that I could control electronically. In grade school, although I was an "A" student, I would daydream about driving an electronic car through the classroom instead of focusing on my schoolwork.

Back then, R/C was more popular with airplanes. Cars were very expensive and very specialized. My father bought me my first radio-controlled car when I was 12. It was a 1/12-scale Jerabee gas. By age 14, I was racing in local clubs. A group of local enthusiasts in Los Angeles formed a club called "The Crenshaw R/C Sophisticates"; that's how I began my racing career.

RCCA: What made you decide to manufacture products for the R/C industry?

EM: Well, when my dad bought my first R/C car for me, our deal was that I had to maintain it myself. I learned to be creative in my means of repair and, due to lack of finances, I had to be very resourceful. Most things I made for my own personal use, but other racers requested that I make items for them, too.

Pretty soon, the popularity of and demand for these items spread, not only through the local clubs but also throughout the entire R/C

industry. As the years went on, my entrepreneurial spirit grew. By the time I finished high school, I had opened my first factory to manufacture R/C products.

A small bank loan and a co-sign from my parents brought forth the thriving company known today as MIP.

RCCA: When was MIP launched?

EM: It began in 1978 as Moore's Ideal Products and Hobbies. Two years later, I shortened the name to Moore's Ideal Products because I decided to focus on design and production rather than retail.

RCCA: What was MIP's first product, and when was it released?

EM: The first products I manufactured were sealed, grease-filled miter-gear differentials for 1/8-scale gas cars. That was back in 1978. I remember spending the first few days after the shop opened filling those diffs by hand. We were the first company to offer these products in the U.S.; previously, they were only obtainable overseas. I still have the original drawings; CAD was not widely available then.

RCCA: Where did you operate your business at that time, and how many people did you employ?

EM: MIP started in southwest Los Angeles. The area was zoned industrial; however, we operat-



ed out of a 500-square-foot converted office and garage. Initially, I worked alone. By the end of the first year, however, we were a crew of four working part time, full time and overtime, as time went on.

RCCA: How many people does MIP currently employ, and what are its manufacturing schedules?

EM: Currently, MIP runs two shifts of manufacturing and employs approximately 25 people full time. Our engineering and manufacturing facilities are open from 6 a.m. to midnight, five days a week. Additionally, our administrative offices include sales, customer service, quality control, electronics, engineering, in-house graphics and advertising. Our regular business hours are 7 a.m. to 3 p.m., Monday through Friday.

RCCA: Does MIP manufacture for industries outside of R/C?

EM: From the beginning, MIP has offered its designing, machining and manufacturing services to outside engineering companies. Though our name is most clearly established within the hobby industry as a manufacturer doing business as "MIP," as well as a provider

INNOVATOR AT WORK

(Continued from previous page.)

of OEM products that are marketed under another name, MIP manufactures precision-machined products for a host of industries ranging from full-scale racecar components to aerospace.

RCCA: Which products are MIP's best sellers?

EM: We have several products that sell well within different segments of the racing population. The hot sellers for gas are clutches, stingers, pipes, flywheels and temp gauges. And of course, the top product for all levels of racing is our CVDs.

RCCA: MIP's CVDs are extremely popular among racers and backyard bashers alike; in your opinion, why do so many racers rely on MIP CVDs?

EM: I think the word "reliability" is key here. They're also priced reasonably, which gives racers and backyard enthusiasts the value they demand from these types of products. MIP has invested tremendous research and development into its CVDs; we manufacture them from select grades of material that meet our rigid specifications. We are tooled to produce CVDs in high volume without sacrificing the custom-built-part quality that MIP has built its reputation on.

RCCA: Anyone who has been involved in R/C racing for a while knows Sue Christensen and her son, BJ. Sue has been warmly referred to as the "mom" to all R/C racers because of her many years of devotion to the hobby. Her son BJ is also well respected throughout the industry as a serious racer and as a person with vision. I think that you're very fortunate to have this mother-and-son team working for you, but I've always been curious about one thing: how did the Christensens come to join MIP?

EM: In the late '80s at a track known as Hobby Bench Raceway, the Christensen race team were avid users of MIP products. BJ, who was in elementary school at the time, and his brother Mike, then in junior high, lived in Covina, California, and frequented the local tracks with their dad, Wayne. Sue was also at the track as team coordinator and inspiration. I had mentioned to them that I was moving MIP to Covina, and they said to let them know if I needed any help. After the move, Sue and



Eustace Moore, Sue and BJ Christensen.

her sons came by for a factory tour, and I asked them if they were serious about offering their help. Within the first week of the move, Sue was helping me in the packaging and assembly department.

Sue's career at MIP has blossomed. She moved from assembly to packaging, from packaging to bookkeeping, then took on administrative responsibilities from there. She is now the general manager of MIP. Her constant enthusiasm and excitement about MIP are unparalleled. Through Sue's hard work and dedication, MIP has grown to be the company it is today. Over the years, both BJ and Mike have held positions within the company. Like his mom, BJ also started in packaging. He eventually left the company to continue his education and develop a career in graphics. He recently returned to MIP as a graphic artist, and his talents are exhibited in all of our advertising and promotional materials. BJ now manages MIP's latest profit-making center, MIP Graphix, a division of MIP that provides advertising and promotional services to outside industries. These services include design and production of full-color and black-and-white ads and CD covers, writing copy, Web-page development and, with the acquisition of our new vinyl cutter, full production of quality signs.

I would like to thank both Sue and BJ for sharing a part of their life with MIP. MIP has truly benefited from their contributions and looks forward to a promising future for them.

RCCA: As a closing question, is there anyone you would like to acknowledge as being an inspiration in your life?

EM: It almost feels unfair to say that one person or a group of people formed my inspiration. Everything and everyone around me inspires me.

RCCA: Eustace, we'd like to thank you once again for taking the time to answer these questions, and we wish MIP continued success. ■

Speed Shop

Yokomo YR-4M2 Refinements

Yokomo USA* announced that all the YR-4M2 touring-car kits shipped to the U.S. will include Yokomo's new large-capacity, anodized-aluminum shocks and new graphite shock towers. The M2's previous red micro shocks were light, but they lacked the tuning features racers demand. The new shocks hold more fluid, so they're more sensitive to oil-viscosity changes; they also come with interchangeable pistons and springs, and that allows the tuner more possibilities. The new, larger graphite shock towers feature many camber-rod and shock-mounting choices.

The new suspension system has proven formidable on the track; at the NORRCA Road Course Nationals, Yokomo M2s dominated the event by taking first through third in the Modified Sedan class. All three cars had large-capacity shocks and prototype shock towers.

Yokomo also announced that its hot new MX-4 4WD off-road buggy has arrived on our shores and will be available by the time you read this. The MX-4 is based on Team Yokomo driver Masami Hirokawa's IFMAR World Championship-winning car and boasts an impressive list of racing features. If you would like more information on the YR-4M2 or the MX-4, give Yokomo USA a call—(510) 284-5778.



YR-4M2



MX-4

Let GTP Dial in your Ride

GTP* recently released a new line of Speed Max 5-spoke wheels in two offsets (185mm and 188mm). They are perfect for the Tamiya TA03F, Traxxas 4-Tec and other touring cars with similar front and rear widths. By installing the 185mm wheels on the TA03, you'll widen the car from approximately 183mm to 185mm. If you install the

188mm wheels, it will still meet the 190mm ROAR and NORRCA maximum-width rule. As you know, increasing a car's width increases its stability, and that's a major benefit. Many racers install the 185mm wheels on the front and the 188mm wheels at the back because a slightly wider rear increases turn-in steering. This tuning tip is a major benefit on the TA03F,





Hop-ups from HPI



HPI* has just what you need to keep your Nitro Star engines running cool and strong.

- Machined, anodized-aluminum heat-sink head for the stock Nitro Star .12E features a larger cooling area and more cooling

fins for improved heat dissipation. It allows you to run your engine slightly leaner for improved performance while receiving more airflow. It's bright purple—looks cool—and comes with a new head gasket, replacement head bolts and an Allen wrench (part no. 1702, \$45).

- Super Chassis for the Nitro RS4 Mini. This has all the features found on the RS4 Super Chassis: 3mm S7075 T6 anodized-aluminum, counter-sunk screw holes, belt cutouts and great customized looks. It also features tuning extensions on the chassis that allow racers to drill out dimples on the suspension arms and use long setscrews to adjust suspension-arm droop. The Super Chassis comes with all the necessary fasteners and is a must-have option for the Nitro RS4 Mini (part no. A904, \$79).



HPI has also released a couple of racing-oriented items for the new RS4 MT 4WD stadium truck.

- Universal drive shafts are made of solid steel as replacements for the stock dogbones and stub axles. On the long-suspension-travel MT, Universal Dog Bones will improve drive efficiency, and that means smoother performance. Part nos. A518 (front), A519 (rear); \$34.



- Super Shocks replace the RS4 MT's stock nylon shocks. These hard-anodized, gray aluminum shocks come with HPI's soft Black springs, Teflon-coated shock pistons and stainless-steel shock shafts for ultra-smooth performance. Racers can choose from five pistons for precise track tuning, and for leak-free operation, the shocks have double O-ring seals on both the top and the bottom. Part nos. A723 (front), A725 (rear); \$36.



and one that Tamiya factory driver David Jun is very familiar with.

The wheels are available in standard narrow, medium narrow and super narrow and come in black, white and chrome. For stock racing, choose the super narrow; the weight saving will be noticeable on the track.

GTP also distributes many of the leading Japanese tires—Ride, Cross, Tech Racing, Speed Max and Pit Shimizu. The photo shows Ride's V-compound super-narrow slicks and S-compound radials mounted on GTP/Speed Max 5-spoke 188mm chrome wheels.

Ride's slick racing tires are temperature-rated. For cooler conditions (below 50 degrees), choose the V-compound—Ride's softest. For normal conditions (50 to 80 degrees), try the S-compound. When the track surface starts to warm up (above 80 degrees), the G-compound is just the ticket. The radials are available only in the S-compound (medium hardness), but they provide plenty of traction because of their aggressive directional tread pattern. The slicks and radials both feature inner reinforcing belts for superior handling.

RACER PROFILE JUKKA STEENARI

Jukka Steenari may not be too well known in the U.S., but his name is well known to racers throughout Europe. Jukka was a factory driver for Team Schumacher for several years and has won several major European titles. In the U.S., Jukka finished in the top 10 at the 11th Annual Reedy International Race of Champions and recently finished second in the 4WD class at the IFMAR World Championships. Jukka is now a Team Losi factory driver and will be racing Team Losi cars and trucks.



VITAL SIGNS

Age: 21

Sponsors: Team Losi, Team Orion (batteries and motors), Novak, Sanwa and Lunsford

Years involved in the hobby: 13

Favorite racing class: electric off-road

Closest competitors: all the professional drivers, because they practice more and attend more races

Number of titles: won the Eurochamps three times, the Florida Winter Champs once and came in second in the 4WD class at the IFMAR Worlds

R/C Car Action: First of all, Jukka, congratulations on your fantastic performance at the IFMAR Off-Road World Championships. Our readers are always interested in hearing about young new talent, and I'm sure that we're going to be hearing a lot more about your talents in the future. Why don't we start with some general information?

RCCA: Where were you born, and where do you presently reside?

JS: I was born in Helsinki, Finland, and still reside there.

RCCA: What is your current profession? If you're a student, what are your scholastic goals?

JS: I am studying mechanical engineering. I should hopefully complete all of my courses within five to six years.

RCCA: Why do you like off-road racing so much?

JS: I just love the power slides!

RCCA: Which racing class do you find to be the most difficult, and why?

JS: There really isn't one!

RCCA: How long did you race for Team Schumacher?

JS: I was a factory driver for Team Schumacher for over two years and have raced their cars for over 10 years! Many thanks for their great support over the years.

RCCA: How do off-road and on-road racing differ in Europe compared to in the U.S.?

JS: Driving styles are different in Europe due to the different types of tracks that we race on. I also think there is more respect on the track between the drivers in Europe.

RCCA: Why did you decide to become a Team Losi factory driver?

JS: As an engineering student, I'm very interested in Team Losi's smart designs and advanced engineering. I am hoping to learn a lot from them because I think they make the best cars in the world!

RCCA: What is the most difficult aspect of being a factory driver, and does living so far away have any effect on the factory's support?

JS: Living so far away has no effect on factory support. I totally rely on all of my supporters. Being a factory driver naturally gives you more responsibility at races, but that only helps me go even faster.

RCCA: Which drivers do you enjoy racing with the most, and why?

JS: All racers who enjoy racing as much as I do.

RCCA: Do you have any words of wisdom that you can pass along to our readers?

JS: Along with practice, get into tuning your car, as well; learn to feel and understand different setups on your car. That is the most interesting area of racing.

RCCA: Thanks again, Jukka. See you at the races. ■



RACERnews

The 18th Annual U.S. Indoor Champs

THE LAST LAP

LET'S PICK UP the action at the U.S. Indoor Championships in Cleveland, OH. This, the longest-running 1/12-scale on-road championship series, just celebrated its 18th and, unfortunately, final anniversary, according to the Northeast Ohio Radio Control Auto Racers (NORCAR).

After 18 years, the race organizers are just plain tired. The event could continue, though, if one of the U.S. R/C sanctioning organizations stepped up and agreed to share some of the responsibility. This is the only race—to the best of our knowledge, anyway—that is held inside the grand ballroom of a major hotel and at which the drivers pit from their respective hotel rooms. Room service and R/C cars; what a concept! It's too bad this might be the end of a long tradition in R/C racing.

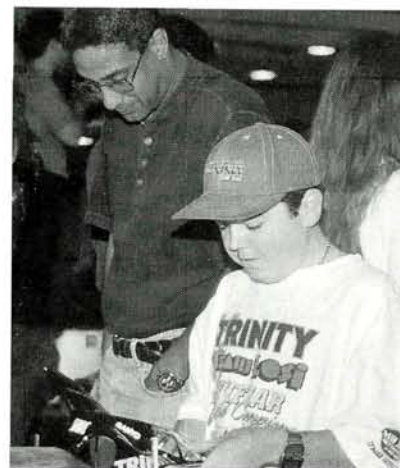
Team Trinity* brought along some heavy firepower in the form of world champions Joel Johnson and David Spashett. Team Associated* drivers Josh Cyrul, Jon Orr and Mike Lufaso were also incredibly competitive and had the championship in their sights as well. Newcomer to the limelight and Connecticut resident Mike Dumas surprised everyone with his CRC* Speedmerchant by qualifying 10th in the A-Main event.

QUALIFYING AND A-MAIN OVERVIEW

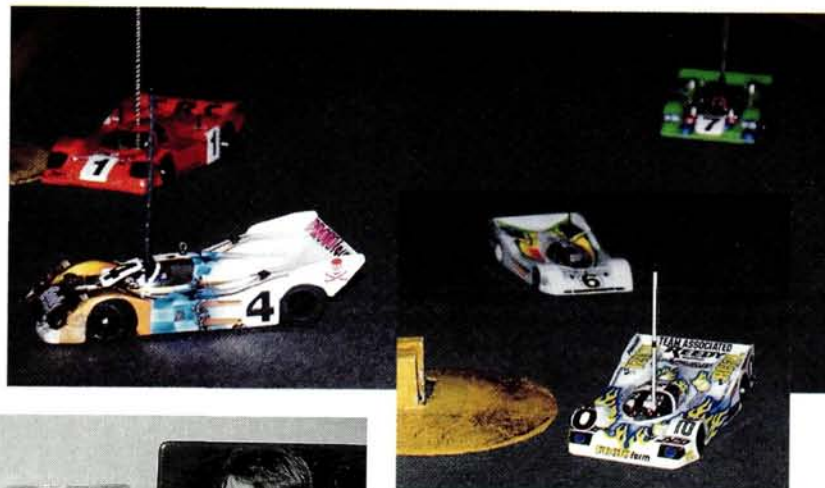
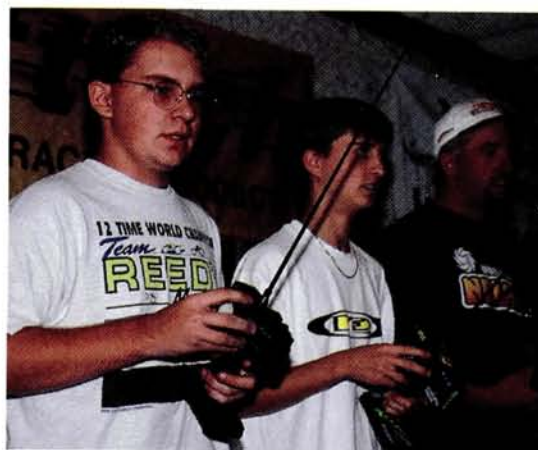
• **1/12 Modified.** After five 8-minute qualifiers, Joel Johnson's 38/8:03.79 first-round time was the fastest and gave him the TQ honors. Josh Cyrul was slightly off the mark with his 38/8:04.14 fifth-round finish, though. Jon Orr and Mike Blackstock also stirred things up with identical 38/8:08 best times. During the single decisive A-Main, Johnson turned on the magic once again and piloted his SwitchBlade 12 to victory. Cyrul, who had led throughout the first half of the race, finished second on the same lap as the leader. Orr and Blackstock ended one lap down and in third and fourth places, respectively.



Left: Mike Reedy works in the comfort of his hotel room. I'm sure Mike enjoys attending this race. Above: Team Trinity's motor wizard Rob Cutman works while factory racer Mike Blackstock supervises. Right: yes, that's Brian Kinwald. It just so happens that 1/12-scale carpet is Brian's favorite racing class; we bet a lot of you didn't know that.



Above: a view of the drivers' stand. Look carefully; you'll see two world champions. Left: Josh Cyrul pilots his car to victory in the F1 class.



Right: racer Vickie Carrubba shows her stuff in one of the Sportsman stock qualifiers. Far right: Novak Electronics* sponsored the charging station. Racers were able to re-peak their batteries just before their heats.



• **1/12 Sportsman.** Mike Blackstock took the poll after he posted a 37/8:11.73 in the last round of qualifying to upset Josh Cyrul, who had posted a 37/8:13.34 in the first round. David Chester and Joel Johnson were close behind, though, with identical 36/8:02 times. During the Main, Johnson must have sprinkled his magic dust over the track because he won the event after battling it out with Blackstock for a grueling eight minutes. Josh Cyrul ended up in third, while up-and-comer Mike Dumas finished fourth.

• **1/12 Masters.** Here, the drivers must be 35 years old or older to qualify. These drivers are considered the Masters of their trade, and many well-known racers and industry spokespersons filled the drivers' stand. Bob Vanwagner ended on top after posting a 35/8:06.96 best time in the fifth round of qualifying. Skip Starkey and Chuck Lonergan were close behind, though. During the Main, Vanwagner drove his CRC Carpet Knife to victory. Starkey ended by crossing the line 5 seconds later to claim second place, while Lonergan crossed moments after that to steal third. You have to love consistency.

• **F1.** This race began as an exhibition, but quickly became part of the U.S. Indoor Championships. Eight CRC Power F1s made it to the A-Main grid, but Josh Cyrul's Corally F1 finished 3 seconds faster than CRC company owner Frank Calandra to take the TQ honors. Cyrul and Calandra were the only drivers to break the 23-lap barrier during qualifying. Cyrul smoked his competition in the Main and again broke the 23-lap barrier. This time, however, he was the only driver who was able to pull it off. Calandra had to settle for second with a 22/5:04.60, while Terry Rott finished third with a 22/5:07.67.



Above left: the 1/12-scale Mod top three finishers, from left to right: Josh Cyrul, Associated, second; Joel Johnson, Trinity, first; and Jon Orr, Associated, third. Above center: the 1/12-scale Sportsman top three finishers: Mike Blackstock, Trinity, second; Joel Johnson, Trinity, first; and Josh Cyrul, Associated, third. Above right: Bob Vanwagner TQ'd and won the Masters class to earn that big trophy by his side. According to Vanwagner, he owes the victory to his perfectly dialed CRC Carpet Knife, as well as to all the factory support.



Motor and battery giants Mike Reedy of Reedy Modifieds (left) and Ernie Provetti of Trinity have a chat.



Brian Kinwald's Trinity SwitchBlade 12

FINAL THOUGHTS

The Eighteenth U.S. Indoor Championships, as usual, was filled with color and excitement. The fact that the race is held in the grand ballroom of a major hotel gives the event a regal element that is unique in R/C racing. It's a shame that this may be the last time the race will ever be held.

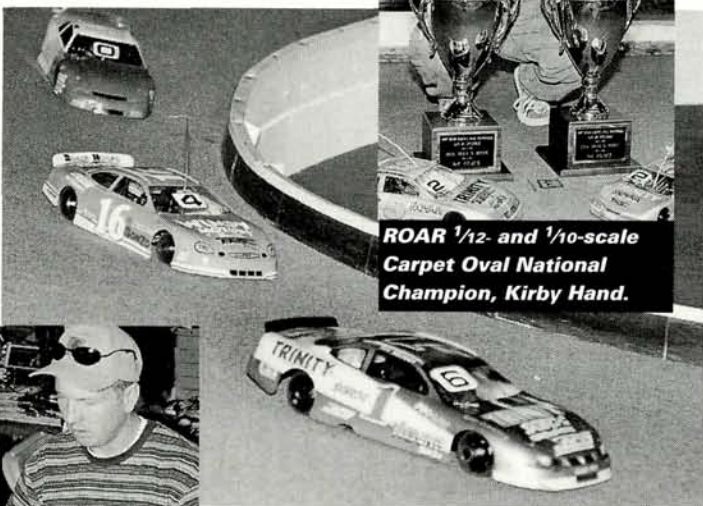
Who knows? Maybe NORRCA will think about adding this event to their long list of professionally run races. If this isn't a hint, I don't know what is. As always, we would like to thank the champions; in this case, Joel Johnson, Josh Cyrul and Bob Vanwagner. We would also like to thank NORCAR and all the wonderful sponsors who contributed to the event.

ROAR Carpet Oval Nats & the U.S. Indoor Champs "Carpet Double Take"

VICTORY IS A LEFT TURN AWAY

SPEAKING OF RACING ... take a ride with us to K/N RC Speedway in Stafford Springs, CT, to witness the '97 ROAR 1/10- and 1/12-scale Carpet Oval Nationals. The nation's top carpet-oval racers congregated to compete in five classes on one of the most difficult short tracks in the country. With lap times of less than 5 seconds, watching this event had the same agonizing effect on your neck as watching a tennis match.

I can't imagine what it was like to be up on the drivers' stand. Team Trinity* made a strong showing with front-runners like Frank Polimeda, Mike Blackstock and Kirby Hand. But no one was ready for Chris Dosek's triumphant but controversial return. Dosek was a prominent R/C racer many years back who was forced to hang up his radio because of a hand injury.



ROAR 1/12- and 1/10-scale Carpet Oval National Champion, Kirby Hand.

Left: Chris Dosek has made a strong comeback, but I guarantee he will never again race

without first testing his transponder. Right: Team Trinity's Frank Polimeda is one of the U.S.'s fastest oval racers, but he ran into bad luck at the ROAR Carpet Nats.



QUALIFYING AND A-MAIN OVERVIEW

• **1/10 Stock.** Bob Pedone took the TQ honors with a 55/4:03.11 after barely edging out Tom Barnhart (55/4:03.60) and George Verbonitz (55/4:03.77) at the finishing line. Thank God for lap-counting computers! After the triple A-Mains had been completed, Charlie Stewart won the national championship based on his consistent driving. Barnhart ended in second again, while Verbonitz finished third and Pedone, fourth.

• **1/12 Stock.** John Hauenstein finished more than 1 second faster than Eric Beltz and Phil Marabella to take the TQ honors. Ed Thuresson and Antonio Denimo also raced very competitively. Hauenstein ran into trouble in the first Main, but won the following two Mains to win the national championship the hard way. Thuresson picked up the pace during the Mains and ended up in second, while Marabella had to settle for third.

• **NASTRUCK.** It was cool to see a field of low-riding NASTRUCKs form a freight train around the track. These trucks handle very well but because of the aerodynamic advantages, the sleek, stock-car bodies were two laps faster. Joe Allevio ended up on top after defeating Ted Connolly and Stan Misiuk by more than 3 seconds. At this level of competition, this is considered a sweep. Allevio continued his winning performance during the Mains and won the national championship. Greg Hartman came from the middle of the pack to claim second, while Luis Martinez followed to secure third.

• **1/10 Mod.** Chris Dosek who was racing for Mighty Modified Motors, nearly lit the carpet on fire when he posted a blistering 61-lap run to take the TQ. Dosek was the only driver to pull off a 61-lap run during qualifying, but the speeds stepped up during the Mains. After the first two Mains, Dosek was tied with Kirby Hand on points. The second- and third-place titles were also very much up for grabs, which meant that Frank Polimeda and Mike Blackstock had to sort things out. As it turned out, Dosek crossed the line first, but the lap-counting transponder was missing from his car—and apparently had been since the start of the race—so no laps were recorded, and he was awarded a big fat DNF for his efforts. Hand was awarded the national championship, while Dosek received a second-place trophy as a consolation prize. Mike Blackstock ended up in third.

• **1/12 Mod.** Frank Polimeda took the podium after defeating teammate Kirby Hand by more than 3 seconds. Polimeda ran into problems during the Mains, though; he won the first Main by once again crossing the line 3 seconds before his teammate, Hand. In the second Main, his car was damaged in a collision at turn three. In the third and final Main, he was disqualified for not meeting the ride-height specifications. No doubt about it, Polimeda was having a bad day. Fortunately, his teammate, Hand, kept it going and ended up winning the national championship. Mike Murphy finished second and Chris Dosek ended third.

FINAL THOUGHTS

The ROAR Carpet Oval Nationals was a truly exciting event, despite the controversies. In this reporter's opinion, before the start of each race, the race directors should have instructed the drivers to pass their cars across the starting line to register a transponder tone. If this simple procedure had been followed, the race results would have been completely different; Chris Dosek would be the present ROAR 1/10-scale Modified Carpet Oval National Champion.

It's common practice to test transponders at sanctioned racing events; nobody knows why they were not tested at this event. The interesting thing is, however, that the mysterious transponder has not turned up to this very day. Perhaps it will, though, just in time for the next ROAR Carpet Oval Nationals.

RACER TIP OF THE MONTH

Masami Hirose
Team Yokomo factory driver

After practice, and just before the first qualifier, take a moment to visualize your car racing through the track. Imagine that your car is racing on a tight line, hugging every corner. Use your practice experience to try to concentrate on the toughest sections of the track. Whether you're racing on- or off-road, there's always a particular section of the track that you will find troublesome. Visualize your car successfully negotiating this tough section of the track.

It is also very important to try to relax before the first quali-

fier. I perform breathing exercises, stretch my muscles and do some light exercising. This helps to get my blood circulating, warms me up and helps me relax and forget about the pressure.

Qualifying well is extremely important. Of course, I always try to qualify as close to the front as possible. If for some reason I end up in the back of the grid when the race starts, I try to stay calm and relaxed and just drive modestly. The race isn't won at the start; it's the car that crosses the finish line first that wins.

THE NEW Maxtec* Shock Wave R/C motor should be considered a milestone because it's the first ROAR and NORRCA-legal motor to be manufactured in the U.S. in over 17 years. There's more to this motor than its

patriotic value, however; the Shock Wave packs some unique new features into the made-in-the-USA package.

We obtained a few Shock Waves to tear apart so that we'd be able to see what makes this chunk of American horsepower tick.

JUST THE FACTS

This might look like just another motor, but you know you can never judge a "book" by its cover; it's what's inside that counts. To better understand the background and makeup of the Shock Wave, we interviewed Maxtec's head designer and motor guru, Joe Maloney, who was kind enough to give us the scoop on this hot new product.

R/C Car Action: We all know that the Shock Wave is made in the U.S. What prompted Maxtec to use U.S. suppliers?

Joe Maloney: Since we were starting from scratch with the Shock Wave, we were able to choose which materials we wanted to use. Japan has limited supplies of raw materials and manufacturing plants to produce the motors, so we turned to U.S. suppliers for their ample supplies and skilled workforce. These suppliers are actually aerospace companies that make products for satellites, fighter jets and so on.

RCCA: You mean to tell us the same materials as are used on fighter planes are bolted onto the back of our R/C cars?

JM: Yes; for instance, the can. The can is made of the thickest possible material and tooled to eliminate taper when it's extruded from the die. This allows the magnets to stay as parallel to the armature as is possible, reducing the air gap. This material also enhances the inherent strengths of the magnets.

RCCA: The armature looks like a normal armature. What's the new technology here?

JM: We consider the armature laminations to be a big feature. Unlike other companies, we use thinner .014 material that allows us to use more laminations. By using more laminations, there's less heat and hysteresis, i.e., loss in magnetic field. Next, we changed the armature's webbing and patented what we call a "Reverse Taper" design. The reverse taper is thin in the center and thick toward the magnets to direct the magnetic field. Other motors have thick or thin webbing and use wire of a diameter that suits the

thickness of the armature used. With our design, we can get the best of both worlds.

RCCA: Are there differences in the windings themselves?

JM: We have a unique system called "Symmetrical Winding." It means that every motor has the copper wires positioned in the same spot and at same pole on every armature, from single to quad winds. This ensures uniform motor manufacturing, meaning there is no difference between team drivers' motors and motors you purchase off the shelf. It's an art form all on its own. This allows the fields to be balanced on every pole. It also allows the wire to be optimized, so we can fit larger-diameter wire into the area while winding it efficiently. This reduces resistance and increases rpm. Of course, all the materials used are of aerospace quality.

RCCA: There's a lot happening on the endbell. Are the hoods silver plated?

JM: Yes they are. We use a high-temperature, high-strength material that is comparable to aluminum; it will not become distorted and will tolerate even the heat from a soldering iron. There are vent holes for maximum airflow and inspection holes for armature viewing and easy cleaning. Next are the blue-anodized aluminum heat-sink plates that help dissipate heat. Finally, the copper damper plates reduce brush vibration and intensify the power flow through the brush. This, combined with the silver-plated brush hoods, dramatically decreases resistance. The soldering tabs were also moved outward to reduce the chance of solder and soldering-iron heat damaging the spring.

RCCA: It seems that a lot of hard work went into the design of the new Shock Wave. Has it been successful on the track?

JM: Over two years of development went into the Shock Wave. We designed it on a CAD/CAM program called Pro Engineer, which is the same program as Ferrari and several R/C companies use to design their vehicles. The Shock Wave has already won several ROAR and NORRCA touring-

Maximum shock value!

■ **Motor can.** The Shock Wave Motor features a 1.5mm-thick can made of advanced, custom-application steel. Large vents span the motor face to provide maximum airflow, and inside, extremely strong 6.1 magnets are used. A high-rpm-rated bearing is precisely seated in the bottom of the can to ensure that the armature shaft spins smooth and true.

■ **Brush hoods.** The brush hoods are perhaps the Shock Wave's most unique feature. They're silver plated, and according to Maxtec, this plating produces 400 percent less resistance than the plated steel of conventional brush hoods. Directly under each brush hood is a copper plate with damper tab that puts pressure on the brushes to reduce chatter and thus increase power flow.

■ **Endbell.** The endbell is made of an advanced polymer composite that resists heat. This stuff is for real; it takes a considerable time to soften this material, even with a soldering iron! The silver solder tabs are in a position that decreases the possibility of solder dropping onto the brush spring. In addition, a blue-anodized heat-sink shield is placed under the hoods for improved cooling.

■ **Armature.** The Shock Wave's armature may look conventional, but it's actually unique. It comprises 61 plates of a proprietary material that, according to Maxtec, is impractical to use for mass production overseas and strictly a made-in-the-USA feature. The armature also features epoxy balancing and the benefits of Maxtec's Reverse Taper and Symmetrical Winding technology (see interview).

car and oval national championships. Internationally, it won the Hong Kong Invitational class, is used by current British national champ William Mitchum and topped the Trinity Road Course Shootout—just to name a few.

RCCA: It sounds as if the Maxtec office will soon need a trophy room. Thanks, Joe, for giving us a behind-the-scenes look at the Shock Wave. We plan to continue our own tests, and we'll pass our findings on to our readers.

*Addresses are listed alphabetically in the Index of Manufacturers on page 217. ■

12th A N N U A L Reedy Race of Champions

Twelve years and going strong

by George M. Gonzalez

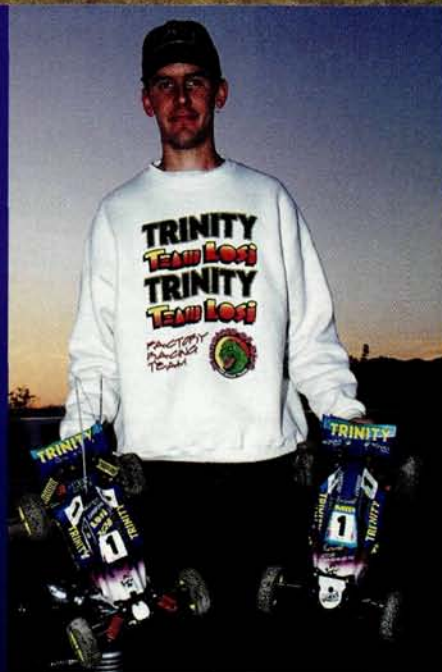


Team Trinity veteran motor builder Rob Cutman (left) congratulates Brian Kinwald on his fantastic performance.

Sponsored by R/C Car Action & Novak

Now in its twelfth year, the Reedy Invitational Race of Champions has become one of the longest-running, non-sanctioned racing events in the country. In fact, it is one of the few racing events that attracts racers from as far away as Europe and Japan.

For those who may not know, the Reedy Race is actually a giant birthday bash for veteran motor-builder Mike Reedy of Reedy Modifieds. What started out as an exhibition race has become one of the most prestigious R/C races in the country. For the second year in a row, M n M Hobbies and Raceway in Corona, CA, hosted the Novak- and R/C Car Action-sponsored Reedy Race. M n M's professional, courteous staff did an excellent job as usual, and no problems or bottlenecks were reported. Past Reedy Races have been fun-filled and exciting, and this year's event was no exception.



Left: 2WD and 4WD Open-class winner, Chad Phillips, with his Losi vehicles.

The 2WD A-Main top-10 finalists
(trophy girl: Christina Russell).



ce of champions

The 4WD A-Main top-10 finalists.



The top three winners in the Invitational class (left to right): Mark Pavidis (second), Brian Kinwald (first) and Masami Hirotsuka (third).



Electronics



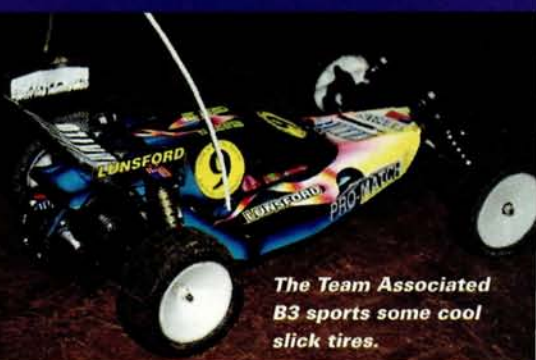
M n M Hobbies' large indoor track features smooth dirt mixed with a great deal of clay and provides a slick, linoleum-like surface that remains consistent day after day and race after race.



Many racers have found that conventional mini-pin racing tires become better and better as the pins wear out. It didn't take long for racers to start using Dremel tools to grind the pins off their tires until only a slick sur-

Traction Action

face was left. As it turned out, slick tires hooked up so well that many cars were on the verge of traction-rolling. Some racers found Pro-Line's* M2-compound and Losi's* Silver-compound tires made the best slicks.



The Team Associated B3 sports some cool slick tires.

The racers who frequent M n M Hobbies love the track's surface because one set of worn tires will last for months. I also noticed many drivers saucing their tires with Trinity* Zip-Grip and motor spray to soften them up even more. Many other drivers turned to Team Losi's Sprint tires in the Silver compound, and several used Pro-Line's Rally Haws in the M2 compound.

Just in time for the event, Pro-Line introduced tires that became quite popular. The new M2 Low-Profile Slicks hook up wonderfully on glass-smooth tracks such as M n M Hobbies'. The tires are available for the Team Losi Double-X4 and for the Double-X, and the Team Associated B2 and B3 buggies that are equipped with Pro-Line's new 2.2 wide front wheels.

You'll be hearing a lot more about these new tires and wheels soon, but if you need more information, give your hobby shop or Pro-Line a call.

SO MUCH CLASS

As in the past, three racing classes were offered: 2WD Open, 4WD Open and Invitational. The Open-class competitions are open to the first 150 racers who sign up, and the slots filled up fast. Open-class drivers in 2WD and 4WD compete in four rounds of qualifying, and the winners in each class are determined in a single Main event. The winners in each of the Open classes are automatically invited to compete in the Invitational class at the next Reedy Race. Racers Todd Cariseo (2WD) and Alex Guerrero (4WD) were the Open-class winners at the previous Reedy Race and as a result, they were invited to compete in the Invitational class at this event.

Invitational-class drivers are chosen to compete. This is considered a great honor among top R/C racers because it reflects upon their tireless efforts and great achievements during the

previous racing season. In other words, these racers are A-Main contenders from every major ROAR-sanctioned racing event of the previous year. The European and Japanese drivers are also chosen based on their accomplishments at EFRA- and FEMCA-sanctioned racing events.

Invitational-class drivers must compete in a six-Main format—without qualifiers—and they're awarded points for the positions they finish in (first = 1 point; second = 2 points; third = 3, etc.). In addition, a racer's worst finish is eliminated and is used only in the event of

Masami Hirosaka says, "Hey!" It seems every time we take a picture of Masami, he's mounting a tire. The funny thing is that he's always mounting them for someone else. Rumor has it that Masami can glue a perfectly balanced tire with just a pair of scissors and his hands; he is truly the guru of rubber racing tires.



Team Yokomo driver Barry Baker and his million-dollar smile. Barry finished in 15th place; very respectable.

a tie. Here's the interesting part: Invitational-class drivers compete in six rounds of 2WD racing and six rounds of 4WD racing. When all 12 rounds have been completed, the points are tallied and the driver with the lowest combined points total is declared the overall champion.

OPEN CLASS

- Qualifying. As in past Reedy Race events, the competition was extremely close. Only 5 seconds

THE ULTIMATE PIT SP



When you pull up the Team Serpent Network web site you pull into gas racing's ultimate pit space. Browse the on-line version of our 80-page, 200-photo Tech Book—a virtual gas car bible that puts 20 years of tuning know-how at your fingertips. Join the Cyber-Pit, a unique interactive web page where racers from around the world share tech information. Download our exclusive START datalogging software...for free. Or read the latest tuning tips in columns by the current World T.Q., the ROAR Champion, and other experts. TSN—get it dialed up, and get your car dialed in.



separated all 10 drivers in 2WD. Chad Phillips ended with the TQ after he posted a 13/4:05.35 best time. Austin Dvorak posted an almost identical 13/4:05.77, but it wasn't good enough for the TQ. Shawn Dassonville was right behind them with his 13/4:06.16, and Chad Bradley wasn't too far back with a 13/4:07.06; talk about close racing.

Chad Phillips picked up the TQ once again in 4WD after doing battle with Shawn Dassonville for four difficult rounds. Phillips and



Peak Performance company owner Rick Hohwart wrenches on his ride. Rick finished in 11th place overall.

Dassonville were the only two drivers to break 14 laps. Phillips ended with a 14/4:17.79, compared with Dassonville's 14/4:17.84. Again, only the lap-counting computer was able to determine the top qualifiers in this class.

• **Mains.** Chad Phillips repeated his performance by finishing first in 2WD and 4WD. The win didn't come easily in 2WD, though; Austin



Team Losi Factory driver Mark Francis works diligently on his Double-X 'CR.'

Reedy Race Hall of Fame

The Reedy Race is now celebrating its twelfth consecutive year. With only a couple of exceptions, a different driver has won the Reedy Race each year. Amazingly, this year's event marked Brian Kinwald's first Reedy Race victory.

So who are the past Reedy Race champions, and which drivers have won it more than once?

Here they are, in alphabetical order:

- Chris Allec—Associated
- Mark Francis—Associated
- Masami Hirosaka—Yokomo (two-time winner)
- Greg Hodapp—Losi
- Rick Hohwart—Associated
- Brian Kinwald—Losi
- Jeremy Kortz—Losi
- Cliff Lett—Associated (two-time winner)
- Chris Moore—Kyosho
- Mark Pavidis—Associated

Dvorak again pushed Phillips to the edge throughout the entire race. Phillips finished with 13/4:08.86 to take the win and the championship. Dvorak finished close behind with 13/4:11.46 to clinch second. Travis Amezcua rolled in a few seconds later to claim third.

The 4WD class didn't threaten Phillips; he won it easily, finishing one lap ahead

RACE IS IN CYBERSPACE



www.serpent.nl



Team Maxtec/Team Yokomo driver Greg Hodapp was smokin'! He put on quite a show and tied for third place when the points were tallied. Way to go, Greg!

of the entire field. Phillips will race in the next Reedy Race as an invited guest. I've been seeing Chad Phillips' name appear in the winners' circle a lot lately; I'm sure we'll be hearing quite a bit about him in the near future. For the record, Jeff Wittman and Travis Amezcua also raced gallantly and finished in second and third places, respectively.



INVITATIONAL CLASS

Because the drivers compete in six heats in 2WD and 4WD, it was almost impossible to guess the outcome until the very end when the points were tallied. Team Trinity/Team Losi factory driver Brian Kinwald and Team Maxtec/Team Yokomo driver Greg Hodapp were tied with 10 points each when the six rounds of 2WD competition were over and their worst times had been thrown out. Team Associated/Reedy factory driver Mark Pavidis, GM Racing/Team Losi driver Brian Dunbar and Team Losi driver Sohrab Tavakoli were all within striking distance, tied with 11 points each.

In 4WD, Kinwald smoked the competition by winning five of the six rounds to secure a total of 9 points. Pavidis was also steaming hot and managed to win four of the five heats he raced in, earning 12 points. Team Yokomo factory driver Masami Hirosaka and Hodapp raced competitively, and each earned 14 points for his efforts. After the points had been tallied, Kinwald ended up with a grand total of 15 and was declared the '98 Reedy Race Champion. Pavidis was close behind with a total of 17 points to claim a second-place victory. Hirosaka and Hodapp tied with 24 points, but after their elimination rounds had been factored in, Hirosaka was declared the third-place champion.

Team Associated Factory driver Mark Pavidis hard at work. Mark put on a fantastic performance at the Reedy Race and finished in second place overall. Mark is a world-champion driver and a past Reedy Race champion.



Losi team manager Jack Johnson (right) consults Novak's Tyree Phillips. Some serious bench racing is going on here!

FINAL THOUGHTS

The 12th annual Reedy Invitational Race of Champions, like the 11 races that preceded it, was an action-packed event. We at *R/C Car Action* congratulate Brian Kinwald and Chad Phillips for their spectacular performances, and we thank Novak for their generous sponsorship. We also thank the staff and track crew at M n M Hobbies. Their hard work

and dedication to the R/C hobby is appreciated by all. And last, but certainly not least, we would like to wish Mike Reedy a belated happy birthday. Until next time

Invitational Class

Fin	Name	Points
1	Brian Kinwald	15
2	Mark Pavidis	17
3	Masami Hirosaka	24
4	Greg Hodapp	24
5	Sohrab Tavakoli	25
6	Mark Francis	28
7	Brian Dunbar	29
8	Tom Hodge	31
9	Craig Drescher	35
10	Jimmy Jacobson	35

Open Class 4WD

Fin	Qual	Name	Chassis	Motor	Battery	ESC	Radio	Body	Tires (F/R)	Traction additive	Pinion/spur
1	1	Chad Phillips	Losi	Trinity	Trinity	Novak	Airtronics	Losi	Losi/Losi	Trinity	18/86
2	9	Jeff Wittman	Losi	Trinity	Trinity	Novak	Airtronics	Losi	Losi/Losi	Trinity	18/86
3	3	Travis Amezcua	Yokomo	Reedy	Reedy	LRP	Airtronics	Yokomo	Pro-Line	Trinity	17/84
4	8	Ryan Maifield	Losi	Trinity	Trinity	Novak	Airtronics	Losi	Losi/Losi	Trinity	18/86
5	2	Shawn Dassonville	Yokomo	Reedy	Reedy	LRP	Airtronics	Yokomo	Pro-Line	Associated	17/87
6	4	Mike Walker	Yokomo	Reedy	Reedy	LRP	NA	Yokomo	Pro-Line	Associated	18/87
7	7	Lloyd Dassonville	Losi	Trinity	Trinity	Novak	Airtronics	Losi	Losi/Losi	Trinity	18/86
8	6	Gene Hickerson	Losi	Peak	Orion	Tekin	NA	Losi	Losi/Losi	Trinity	18/86
DNS	5	Patrick McCarson	Schumacher	Peak	Orion	Tekin	Airtronics	Schum	Pro-Line	Trinity	19/95
DNS	10	Derek Pocaroba	Losi	Trinity	Maxtec	Novak	Airtronics	Losi	Losi/Losi	Trinity	20/86

Open Class 2WD

Fin	Qual	Name	Chassis	Motor	Battery	ESC	Radio	Body	Tires (F/R)	Traction additive	Pinion/spur
1	1	Chad Phillips	Losi	Trinity	Trinity	Novak	Airtronics	Losi	Losi/Pro-Line	Trinity	18/84
2	2	Austin Dvorak	Associated	Reedy	Reedy	LRP	Airtronics	Associated	Pro-Line	Homebrew	20/81
3	7	Travis Amezcua	Associated	Reedy	Reedy	LRP	Airtronics	Associated	Pro-Line	Parks	20/81
4	9	Ryan Maifield	Losi	Peak	Orion	Tekin	Airtronics	Losi	Losi/Pro-Line	Trinity	NA
5	8	Lloyd Dassonville	Associated	Reedy	Reedy	LRP	Airtronics	Associated	Pro-Line	Associated	18/84
6	3	Shawn Dassonville	Associated	Reedy	Reedy	LRP	Airtronics	Associated	Pro-Line	Associated	20/83
7	10	Bryce Beaver	Associated	Reedy	Reedy	LRP	Airtronics	Stock	Pro-Line	Associated	20/81
8	5	Steve Chamberlin	Losi	Peak	Orion	Novak	Airtronics	Losi	Losi/Pro-Line	Trinity	21/84
9	6	Jason Corl	Associated	Reedy	Reedy	LRP	Airtronics	Associated	Losi/Pro-Line	Trinity	21/84
10	4	Chad Bradley	Associated	Reedy	Reedy	LRP	Airtronics	Stock	Pro-Line	Associated	20/81

This is YOUR PAGE!

That's what "Grassroots" means—from the roots—the ground up; and that means YOU!—real, live R/C'ers—readers—an entire page of your stuff! Show the world—yes, everywhere—from here to there—what you and your R/C friends are doing. Wanna brag? Here's the spot. Go on; show us!

Send photos with captions to "Grassroots Racing," *Radio Control Car Action*, 100 East Ridge, Ridgefield, CT 06877-4606.

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ext. 085F

Hobby Shack Parking Lot
(714) 964-8846

Hobby Town USA Parking Lot
(402) 434-5050

Trinity Street Spec Series
(908) 862-1705

Trinity Spec Series Lugnut Raceway

On December 7, racers from eastern Pennsylvania and southern New Jersey gathered at Lugnut Raceway in Hatfield, PA, for one of Trinity's Street Spec Series races—one of only two roadcourse programs on the winter schedule. With nine full heats of races, the action was nonstop from noon until closing. Bill Henning and his crew ran two regular heats followed by a third shuffled heat and the Mains.

Even though many of those present were diehard oval racers who had never run a roadcourse before, it's obvious from the photographs that everyone had a terrific time. Surprisingly, there wasn't much difference in qualifying times between the two heats of Pro Spec sponsored drivers and us regular folks. I guess that's what Street Spec racing is all about!



Plenty of action happened on the track. The corner marshals saw their share of action, too.



Kirby Hand came to do a little driving. At a Street Spec event, sponsored drivers have no advantage except their driving skills. Everyone must run his equipment as specified in the Trinity Street Spec handbook.



Plenty of pit space was available to the racers, and it appears they used every bit of it. A collection of racing memorabilia on the walls gave the drivers something to look at between heats.

Hobby Planet's road track looks as if it would be a blast to race on. Its scale features, such as striped corners, a grass infield and lights for nighttime driving, make you feel as if you're racing a full-scale car.

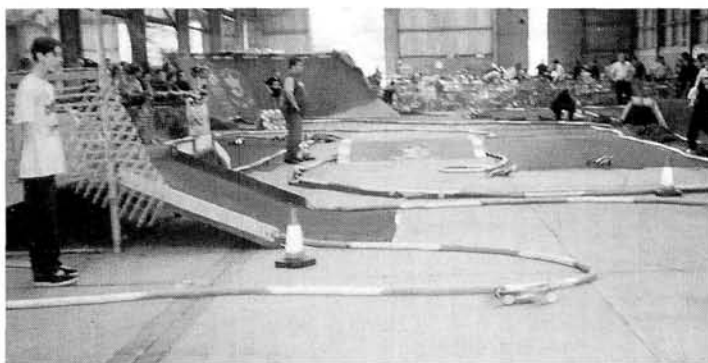


Stylin' Race Facilities

Want to see a spectacular race venue? Check out these pictures sent to us from Hobby Planet Racing Club in Campinas, São Paulo, Brazil. Some serious on- and off-road racing takes place here. With its striped lane barriers and winding roadcourse, the asphalt track appears just as sophisticated as a real racetrack. The off-road track looks challenging and well maintained, too.



Above: the off-road course looks challenging and fast. When they're racing on a track of this caliber, these guys don't mind long days. Left: where else can you find brick pit areas with power outlets at each table? There's even a sign to designate which pit areas are for the on- and off-road tracks.



Below: how many tracks have an embankment with a 60-degree incline? These guys are pretty brave to zip their cars around this bend, lap after lap. The two blurs on the bank are trucks; you need speed to beat the bend!



THE BIG EVENT

The Worcester Model Car Club in Worcestershire, U.K., sent these photos from their annual Malvern race. To prepare for the event, they lay down six tons of 4-foot-long grass, set up banks (one of which measures a whopping 60 degrees) and jumps that are up to 2½ feet high, and much more. During the race weekend, more than 100 drivers show up for this wild event. They run various classes, including 1/10 gas trucks, and say it gets extremely loud inside the 400x55-foot shed.

Left: this huge track looks like loads of fun; can you believe they only set it up once a year? Lots of planning goes into an event like this.



Above: on the grass-covered back straight, you can see that the 2½-foot-high jumps are also 16 feet long; can you say "serious air time"?

Cut a Reclaim that mangled mod!

Commutator

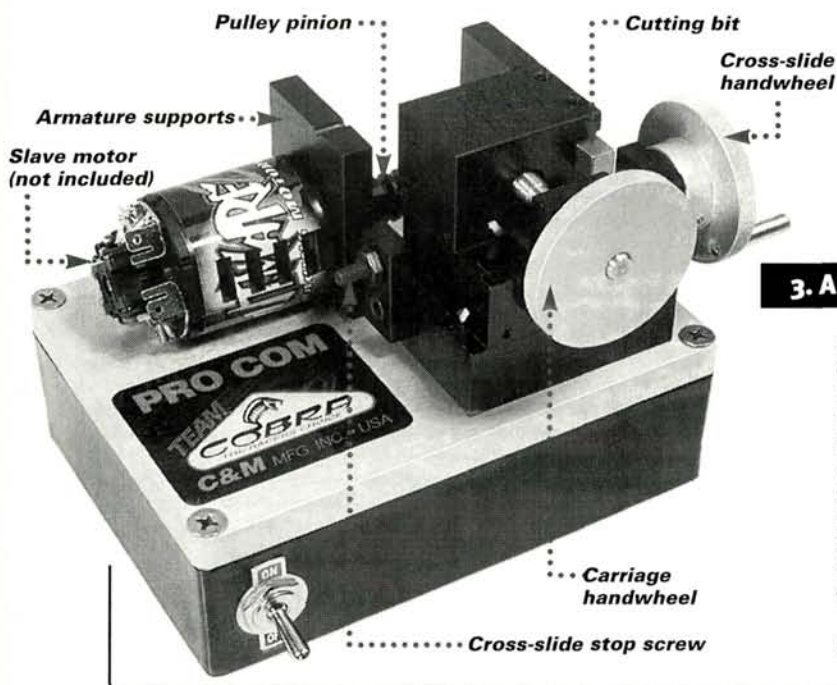
by Greg Vogel

WE'VE ALL HEARD that "speed costs"; I suggest that little aphorism be amended to include "... and it never lasts." Once you've bought the speed, it's hard to hold on to it. This is especially true of modified motors, which quickly lose their performance edge, no matter how faithfully you clean and lube them. Commutator wear is the culprit: grooves, pits, chips and carbon buildup on the once-bright copper finish of your comm. Why does this happen?

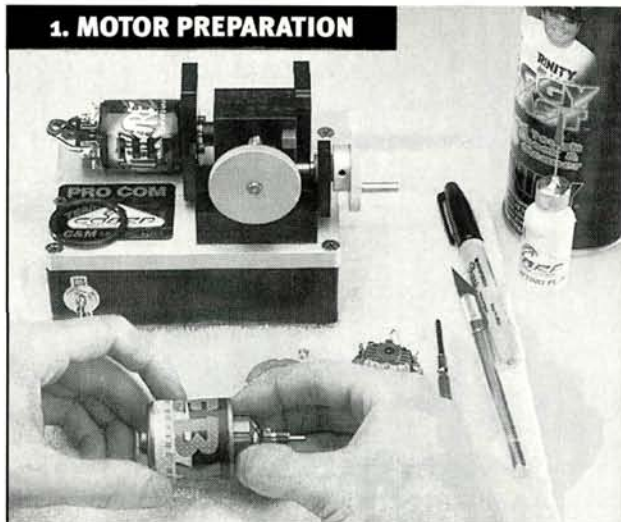
Here are some factors that lead to excessive wear:

- Massive amp-draw causes the brushes to wear rapidly on the comm's surface.
- Hard braking causes arcs and sparks between the brush and commutator surface.
- Dirt, carpet lint and dust slowly deteriorate the surface.
- Comm drops attract debris and cause a buildup that will abrade your comm like sandpaper.

Those are just a few of the reasons why your mod is getting slower. Ultimately, the motor will become an expensive paperweight. How do you revive it? By truing, or "cutting," the commutator with a special lathe—that's how. This process removes worn material and reveals a fresh surface for those hungry brushes to gnaw on. Cutting the comm will extend the life of the motor and replenish lost power. Read on; I'll guide you through the steps to properly cut and care for your motor's commutator.



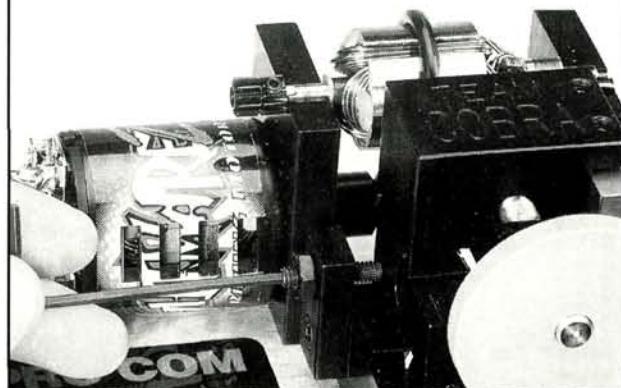
1. MOTOR PREPARATION



The first step is to take the motor apart. With a hobby knife, scribe a small line from the endbell to the can. This allows the timing setting to be retained and ensures that you'll reassemble the motor at the right polarity when you've finished. Pull the motor apart over a white towel, as this will capture any spacers that may fall out. Remember the order of the parts and how many washers were on the top and bottom of the armature shaft. Next, spray the armature with motor spray to clean off any dirt, and put it aside to dry.

2. LATHE PREP

While the armature is drying, pull out the comm-cutting lathe. For this article, we used Team Cobra's* Pro Com (part no. 2000L) modified motor lathe with Powerbase; this made it easy to power the lathe via an enclosed 4-cell pack (not included), and the built-in charging jacks made the lathe a build-it-and-forget-it tool. We installed Team Cobra's optional diamond-cutting bit (part no. 2000D) for a smoother cut. When you assemble the lathe, you will also need to supply an 05 motor to spin the armature; we used a Peak Performance* Nightmare in the photos, but any retired stock motor will work fine.

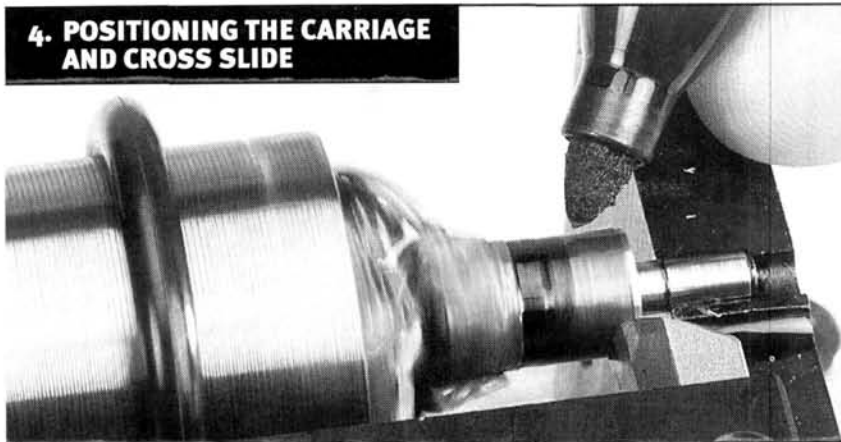


3. ARMATURE PLACEMENT

Before you begin, move the cross slide back and move the carriage over to the right; you do not want to take a chance on damaging the bit. Place a drop of oil in each groove on the armature supports, then place the armature in the grooves. If there is any play between the armature and support, take up the slack with the provided nylon washer, and screw your pinion onto the other side. You do not want to squeeze the support; you just want to take up the slack. Next, remove the armature, slide the drive O-ring over the arm and place it back in the supports. Stretch the drive ring over the pulley on the motor. Using the handwheel, crank the carriage up to—but not touching—the comm.

Now it's time to set the travel stop. Adjust the stop to prevent the bit from hitting the welds on the armature.

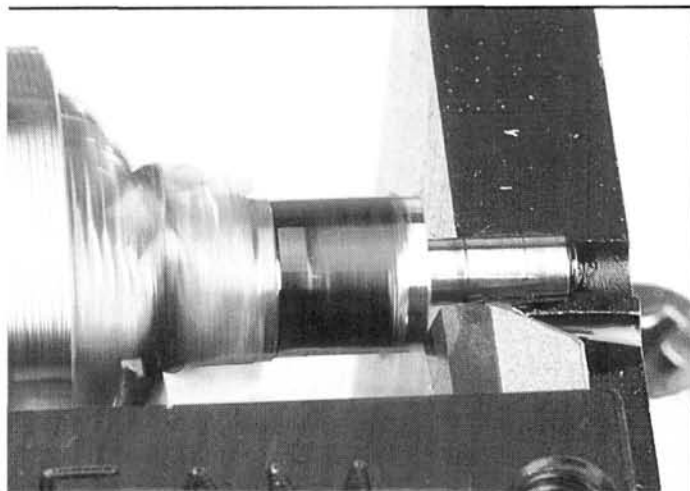
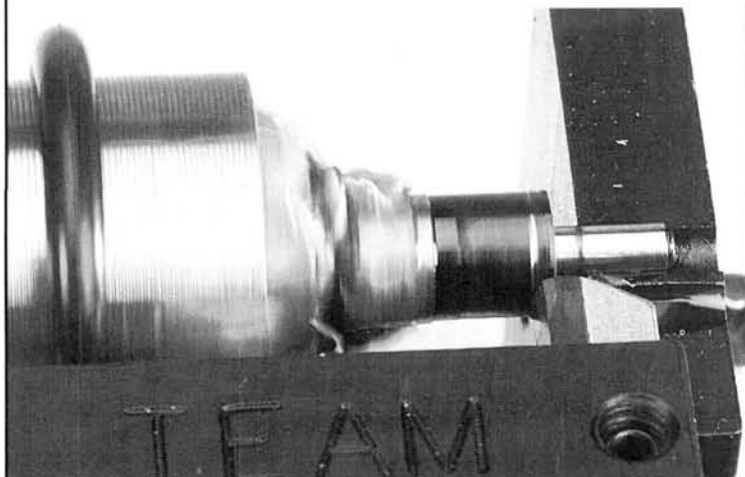
4. POSITIONING THE CARRIAGE AND CROSS SLIDE



Turn on the lathe. When the armature spins, it rotates clockwise, if you're looking at it from the commutator end; or, think of it this way: the arm rotates up past the bit. If it is backwards, you will need to reverse the polarity at the drive motor. With the arm spinning smoothly, run a black marker on the comm; this allows you to see the worn surface better when you're cutting it. Slowly turn the carriage handwheel, positioning it $\frac{1}{32}$ inch from the left edge of the comm. Move the cross-slide handwheel so the cutting bit's point is $\frac{1}{32}$ inch away from the comm's surface.

5. MAKING THE CUT

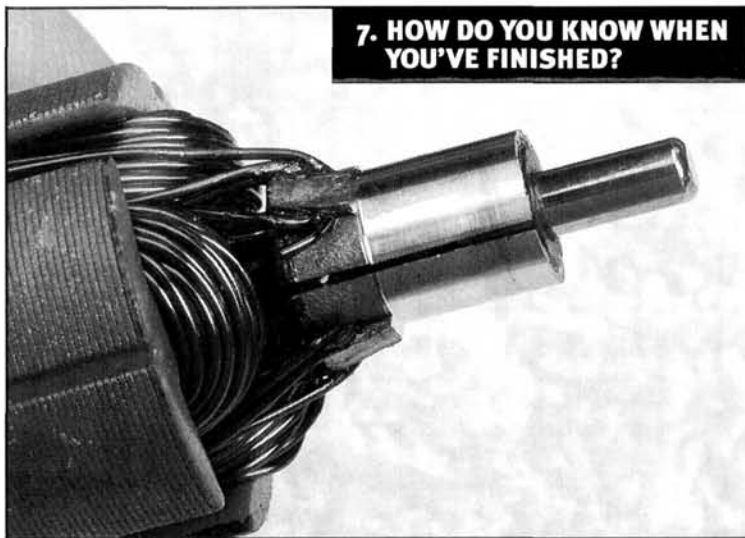
Gently turn the carriage's handwheel until the bit touches the comm and you see a thin copper line, then stop. There's no need to cut any deeper; just turn the cross-slide handwheel to complete the pass, past the right edge of the comm. Turn the lathe off and inspect the comm; most of the black ink should be worn away.



6. FINISHING THE CUT

Turn on the lathe again. Put a couple of drops of comm-cutting fluid on the back side of the rotating comm (be careful; some may splash off). Now turn the carriage handwheel to the screw stop and turn off the lathe. You will notice most of the marker is gone; this indicates material has been removed. Turn the armature by hand; if there are any black spots left, you will have to repeat the cutting process. When recutting, turn the cross-slide handwheel in small increments. Remember: when you cut 0.001 inch, the actual diameter is reduced 0.002 inch. Lighter cuts extend motor life. I highly recommend the use of Team Cobra's cutting fluid instead of light oil; comm fluid is designed to remove material, while oil is meant to separate operating surfaces. You'll get a better cut with comm-cutting fluid!

7. HOW DO YOU KNOW WHEN YOU'VE FINISHED?



After making your passes and turning off the lathe, rotate the armature by hand to check for marker spots; there shouldn't be any. The entire commutator should have a sheen like the bottom of a compact disc. You don't want a polished, mirror finish; this type of surface will glaze more easily. After you have achieved the desired finish, back the cross slide and carriage away from the armature and spray the armature and commutator with motor spray to get rid of any oils and copper shavings.

8. REASSEMBLY

Now it's time to reassemble the motor. Just put it back together the way you found it, insert the original number of washers on each side and put a couple of drops of oil on the bearings. It is highly recommended that you replace the old brushes with new. Old, damaged brushes will ruin that beautiful comm you spent so much time refurbishing.

THE RESULTS

That wasn't so bad, was it? If you invest in a lathe, it will pay for itself in the long run (or not-so-long run, if you're using hand-wound mods); you can refurbish your old motor instead of buying a new one to stay competitive. Just don't be surprised when you find a lot of "new friends" coming to you with their tired motors at the next race!

**Addresses are listed alphabetically in the Index of Manufacturers on page 217. ■*

race, the 3x8mm cap-head screw that holds the steering knuckle on the bottom suspension arm had loosened and been thrown off the car. Next time, I'll use thread-lock on these vital screws.

After the race, I decided to see how the 4-Tec would respond with a nasty 11-turn Trinity D2 modified motor bolted in. To my amazement, it accepted this massive dose of horsepower and distributed it evenly all over the racetrack! Naturally, I was impressed.

FINAL THOUGHTS

Traxxas has once again proven that high performance is not necessarily synonymous with high price. The RTR 4-Tec will reward first-time racers with instant gratification and hours of street-corner racing fun. The unassembled kit is perfect for those who would like to learn more about R/C mechanics or would just plain enjoy doing it themselves. Either way, the 4-Tec may be transformed into a competent performer

that's worthy of serious competition.

If you're thinking about getting started in parking-lot racing but are concerned about high costs, make sure the 4-Tec is at the top of your "must see" list. The Traxxas 4-Tec may change your outlook on R/C racing altogether.

*Addresses are listed alphabetically in the Index of Manufacturers on page 217. ■

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4 & 7 Cell Also Available		Peak Performance 24°		FANTOM MOTOR DYNO	
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6 Cell Matched	\$30.00 Ea	Race Prep R, P & H Cut		Race Prep Powerzone	
High Voltage Team Cells... Call		Trinity #4077, #4383, #4444, #4499		B & T Brush Springs	
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Sanyo N500 AR	\$3.50 Ea	Matrix #3018, #3028, #3502		B & T Battery Braid	
Sanyo 600 AE	\$2.50 Ea	Fantom #F-315, #F-312, #F-309		B & T Battery bars	
Sanyo 700 AA	\$1.50 Ea	MPH PRODUCTS		B & T Battery Tape	
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5 Cell Receiver Pk	\$18.00 Ea	MPH 100 Packrat Power Meter		B & T Motor Caps	
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TAMIYA BLAZING STAR

(Continued from page 74.)

hot Trinity Opal motor and the Super Rooster's full-speed reverse, the Blazing Star was capable of some high-speed stunts worthy of the best "CHiPs" episode. My constant braking, accelerating and reversing (along with the low-turn motor) managed to heat up the ESC, but it never even hiccuped. I'm sure the Smart Braking feature (reverse doesn't kick in until the car slows to a safe speed) prolonged the life of the transmission gears.

Off-road, the Star's soft suspension and high ground clearance made it nearly unstoppable, and its jumping prowess was evident as it was launched off curbs, roots, pitchers' mounds and other natural and manmade obstacles. The Super Rooster again proved invaluable, allowing the Blazing Star to simply back out of trouble. However, it couldn't help the Blazing Star when the car was on its lid—which was often, given the abuse I was heaping on it.

In typical Tamiya fashion, nothing bent or broke. The only trouble spot was the motor mount, which might soften if you don't allow some cool-down time between packs; the motor is pretty much buried in the rear tranny, and the lack of cooling airflow can heat things up in a hurry.

FINAL THOUGHTS

I knew I would enjoy this car even before I built it, so it's no surprise that I have such high regard for it. Sure, the suspension has some slop, and you really can't adjust much, but so what? I was too busy having a good time to think about which shock oil might work better, or how I should adjust the rear camber.

If you want to go racing with the big boys, look elsewhere. But if a go-anywhere good time is what you really want from a car, check out the Blazing Star.

*Addresses are listed alphabetically in the Index of Manufacturers on page 217. ■

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1997 UPDATE
RACE powers Japanese team to 4th and 8th place in 1997 On-Road World Championships.

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1996 JRCC SERIES RACE

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1st Place:	Race 2 (Takahashi)
1st Place:	Race 3 (Arakawa)
1st Place:	Race 4 (Miura)
1st Place:	Race 5 (Takahashi)

FLAG-1 THREE HOURS ENDURANCE RACE

1st Place:	R/C Control World Magazine Team (Miashita, Takahashi, Ishii)
2nd Place:	F. Planning Team (Kitade and Suzuki)
3rd Place:	Mugen Seiki Sting Team (Sanada, Oosaka and Kawamoto)

Track Directory

FREE! Track owners! You can be included in this directory brought to you by Pro-Line. Just fill out the coupon on page 245.

YOUR 1998 TRACK GUIDE

Key to Symbols

	Indoor
	Outdoor
	Off-road
	Oval
	Dirt oval
	Carpet
	Concrete
	Asphalt
	On-site hobby shop
	AC power
	Auto lap-counting
	Food available

ALABAMA

Beacon Point RC Raceway, 15717 Beacon Point Drive, Tuscaloosa, AL; Don, (205) 333-8679

Hobbytown USA Raceway, 450-Q Schillinger Rd., N., Mobile, AL 36608; Rob & Kari Baker, (334) 633-8446

Lagoon Park R/C Raceway, 2730 Lagoon Park Dr., Montgomery, AL 36109; Alex Love, (334) 272-6438

Phenix Raceway & Hobby, 2006 Opelika Rd., Phenix City, AL 36867; Chris Watson, (334) 298-9786

R/C Hi-Tech Raceway, 3303 Meridian St., Huntsville, AL 35811; Rick Chambers, (205) 539-1347

R/C Thunder Tracks, 1530 Schillinger Rd., Mobile, AL 36675; Jerry Hurst, (334) 645-2787

ALASKA

Fairbanks R/C Car Club 510 Janae Ave. Fairbanks, AK 99701; Dan Anderson, (907) 456-5494

ARIZONA

Cottonwood R/C, S. 6th St., Cottonwood, AZ 86322; Sal Cirincione, (520) 567-6830

Havasu R/C Raceway, 1400 S. Smoketree (Rotary Park), Lake Havasu, AZ 86403; Jeff Roe, (520) 855-2226

HobbyTown Mountain Raceway, 1500 E. Cedar Ave., Cedar Hills Shopping Center, Flagstaff, AZ 86004; Richard, (520) 214-9887

HobbyTown Raceway, 13802 N. Scottsdale Rd., Scottsdale, AZ 85250; (602) 948-3946

HobbyTown Raceway, 1915 East Baseline Rd., Gilbert, AZ 95234; Dennis, (602) 892-0405

Hobbytown Raceway, 1102 E. 22nd St., Tucson, AZ 85704; (520) 882-8888

HobbyTown U.S.A., 5030 E. Ray Rd., Phoenix, AZ 85044; Linda McFarland, (602) 598-5282

Quarter Flash's Squirting' Dirt Raceway, 16301 S. Santa Rita #C, Sahuarita, AZ 85629; Dave, (520) 625-9274

R/C Sports Mania, 3550 N. 35th Ave., Phoenix, AZ 85017; Brian Dick, (602) 278-3671

Scottsdale R/C Raceway, 3023 N. Scottsdale, Scottsdale, AZ 85251; Scott Antinson, (602) 945-2186

Speedway Hobbies, 2710 N. Steve's Blvd., Ste 8, Flagstaff, AZ 86004; Gary McAllister, (520) 714-1566

Thunder Mountain R/C, 1325B Plaza Mavia, Sierra Vista, AZ 85635

USA Speedway, 5947 W. Alameda, Glendale, AZ 85310; Michael Fleck, (602) 516-1398

ARKANSAS

A.R.C.C.A., 13703 Pleasant Hill Rd., Little Rock, AR 72209; Jim Kifer, (501) 455-2221

Grand Slam Superspeedway, 5300 S. Zero St., Ft. Smith, AR 72901; Bryon Shumate, (501) 648-1994

Sparks R.C. Raceway, 7194 Greene 721 Rd., Paragould, AR 72450; Tommy Sparks, (501) 239-3606

CALIFORNIA

California City R/C Car Track, 8349 Jacaranda Ave., California City, CA 93505; (760) 373-3765

Cameron Park Raceway, 1305 Cameron Ave., West Covina, CA 91790; Carl A. McVey, (818) 962-1120

Cats West/Hawk's R/C Raceway, 1201 West 10th St., Antioch, CA 94509; Mike Rogers, (510) 779-1665

Cycle Art Raceway, 2211 N. Pleasant Way, Fresno, CA 93705; Jesse Shapiro, (209) 233-3665

Discount Hobby Warehouse, 7750 Convoy Ct., San Diego, CA 92111; (619) 560-9633

Freedom Park Raceway/Ventura Roadrunners, Freedom Park Dr., Camarillo, CA 93010; Chris Jones, (805) 656-RACE

Greater Los Angeles R/C Racing Club, 3756 Cardiff Ave., #305, Los Angeles, CA 90034; Nikko Ko

Hobby Central Raceway, 34255 P.C.H., Unit 107, Dana Point, CA 92629; John, (619) 513-0373

Hobby Central II Raceway, 13461 Community Road, Poway, CA 92064; John, (619) 513-0373

Hobby Paradise Raceway, 1880 Art Gonzales Pkwy., Selma, CA 93662; Steve Keiser, (209) 896-4804

HobbyTown, Parktown Plaza Shopping Center, 1350 S. Park Victoria Dr., #21, Milpitas, CA 95035; (408) 945-6524

Hobby Town, 8950 Osage, Sacramento, CA 95828; Roger Hubbard, (916) 381-7587

Hot Rod Hobbies, 25845 San Fernando Rd., #21, Saugus, CA 91350; Rod Weisbaum, (805) 255-2404

Jake's Performance Hobbies, 6650 Commerce Blvd., #21, Rohnert Park, CA 94928; Jake, (707) 586-3375

Just for Fun R/C Raceway, 509 S. State St., Ukiah, CA 95482; Don, (707) 462-7305

K&M Raceway, 22474-A Barton Rd., Grand Terrace, CA 92313; (909) 783-0899

Lake Tahoe Raceway/Sierra Hobbies & Raceway, P.O. Box 9969, South Lake Tahoe, CA 96158; Mark Osser or Greg Smith, (916) 541-4555

Loki Raceway & Hobbies, 1875 Joe Crossen Dr., #8, El Cajon, CA 92020; Ed Mullen, (619) 562-7757

Lucerne Valley Raceway, 32800 Old Woman Springs Rd., #4, P.O. Box 2047, Lucerne Valley, CA 92356; Frank Rodriguez, (760) 248-7305

M n M Hobbies, 4225 Prado Rd., Ste. 103, Corona, CA 91720; Joe Stanovich, (909) 272-3545

M.R.C.A.R., McGreed Loop, Merced Airport, Merced, CA 95340; (209) 723-6662

Nor-Cal Mini-Speedway, 519 Bush St., Woodland, CA 95695; Steve Van Atta, (916) 668-5678

Perris Recreation R/C Track, 120 N. Perris Blvd., Perris, CA 92370; (909) 943-6603

R/C Racing Center and Hobbies, 9842 Channel Rd., Lakeside, CA 92040 (San Diego County); Russ or Cindy Escalera, (619) 443-2270

R/C Velodrome, P.O. Box 2403, Julian, CA 92036; Peyton Read, (760) 765-3463

R.A.C.E., 724 Mangrove Ave., Chico, CA 95926; HobbyTown U.S.A., (916) 899-2977

Race Corner of Marin, 14 Commercial Blvd., #111, Novato, CA 94949; Mike, (415) 883-0388

Race Prep Raceway, 20115 Nordhoff, Chatsworth, CA 91311; Steve Dunn, (818) 709-6800

Racer's Haven Raceway, 7401 White Lane #12, Bakersfield, CA 93309; Martin Buchanan, (805) 835-0441

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Ripon R/C Speedway, 701 N. Acadia Ave., Ripon, CA 95366; Dan Tanis, (209) 599-5160

R.O.C.K.S., 2525 N. Texas St., Fairfield, CA 94533; Mike Learn, (707) 447-0492

Simi Valley Groundpounders, 205 Tierra Rejada Rd., (behind Simi Valley Drive-In), Simi Valley, CA 93065; Jack Kasten, (805) 584-8211

So. Cal R/C Raceway, 19118 Brookhurst St., Huntington Beach, CA 92646; Jim Blauvelt, (714) 963-7484

S.R.S Offroad Raceway, 1038A N. Davis Rd., Salinas, CA; Randy Loveless, (408) 424-4044

Team Air Racing Club, 18208 Imperial Hwy., Yorba Linda, CA 92686; Don or Nicky, (714) 579-7488

Track Heaven, 6196 Child's Ave., San Diego, CA 92139; Loure, 475-2020

Tri-Valley Auto Racers, Livermore Elks Club, 940 Larkspur, Livermore, CA 94550; Mike Stone, (510) 455-6833

Ultimate Hobbies, 2143 N. Tunstun Ave., #6, Orange, CA 92665; Cliff Murukami, (714) 921-0424

Valley R/C Racepark, 146 S. Santa Fe St., Hemet, CA 92344; Valley Wide Recreation, (909) 925-9331 or (909) 654-1505.

COLORADO

MHOR R/C Raceway, 15540 East Batavia Dr., Aurora, CO 80011; Jess Brockman, (303) 343-0151

S&T R/C Raceway, 323 Auburn Dr., Colorado Springs, CO 80909; Tim Bishop, (719) 574-2910

Valley West R/C Club, 2202 I Road, Grand Junction, CO 81505; Waymond Williams, (970) 242-8846

CONNECTICUT

East Lyme R/C Kar Klub, Society Rd., East Lyme, CT 06333; (860) 442-4343

K/N R/C Speedway Inc., West St., Stafford Springs, CT 06076; (860) 684-9896

Racing and Entertainment Center, 29 Olcott St., Manchester, CT 06040; Peter Tierinni, (860) 646-4768

R/C Madness, 640 Enfield St., P.O. Box 64, Enfield, CT 06082; Christopher Marcy, (860) 741-6501

Xtreme Radio Control, 469 Danbury Rd., New Milford, CT 06776; Paul or Pete, (860) 354-4703

DELAWARE

DARCAR Club, Blue Hen Corporate Center, Rte. 113, Dover, DE; Steve, (302)-697-8350.

Eastcoast Off-Road, Rt. 3 Box 256 A, Laurel, DE 19956; Darrin Shockley or Steve Nelson, (302) 875-8160

The Hobby Outlet: Tracks of the Outlet, Salisbury Rd., Dover, DE 19901; Steve, (302) 697-8350

Hobby Stop Speedway, RD4, Box 100, Rte. 13, Seaford, DE 19973; Remy Haynes, Jr., (302) 629-3944

FLORIDA

B+T R/C Central, 811 Playground Rd., Ft. Walton Beach, FL 32547; (904) 863-1666

Brantford R/C Speedway, Rt. 3, Box 240, Brantford, FL 32008; (904) 935-0758

Broward County R/C Race Club, Mills Pond Park, Ft. Lauderdale, FL; Ed Decemero, (954) 525-3304

Coral Springs Roadrunners, P.O. Box 9632, Coral Springs, FL 33075; John Argentinio, (954) 925-8284

First Coast Speedway, 6410 Waltham Dr., Jacksonville, FL 32211; Bob Thompson, (904) 743-2161



5-Fifty-5 R/C Raceway, State Road 555, Bartow, FL 33830; John Goepferich, (941) 678-9111



Frontier Race Track, 15260 N.E. 244th Ave., Salt Springs, FL 32134; Harold Reel, (352) 685-2881



G & C Hobbies

1228 Hypoluxo Rd., Lantana, FL 33462; George, Debbie, or Carol, (561) 547-3812



Gainesville R/C Speedway, P.O. Box 693, Melrose, FL 32666; 130 NW 14th Ave., Gainesville, FL 32601; (352) 495-3600



Greater Orlando Auto Racers, 970 Keller Rd., Altamonte Springs, FL 32714; Dave Mottin



Hobby World Raceway, 7273 103rd St., Jacksonville, FL; Greg, (904) 772-9022



The Hobby Stop Raceway, 5765 Manatee Ave. W., Bradenton, FL 34209; Rich Konnen (941) 798-9638



The Hobby Stop Raceway, 2454 Land O'Lakes Blvd., Land O'Lakes, FL 34639; Rich Konnen, (813) 948-0606



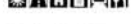
Miami R/C Raceway, 12546 S.W. 88 St., Miami, FL



Minnreg R.C. Club, 6340 126th Ave. N., Clearwater, FL 34624; David Fox, (813) 787-6032



Monster Hobbies, 231 SE 1st Ave., Boca Raton, FL 33432; Steve Augustus, (561) 392-5447



Morris Kohl's Raceway and Hobby Shop, 1202 W. Waters Ave., Tampa, FL 33604; Morris Kohl, (813) 931-1626



My Rose, 1695 W. Indiantown Rd., Jupiter, FL 33458; Mark Watson, (561) 744-3800



NORRA, 3300 Santa Barbara Blvd., Naples, FL 33999; Jerry Pecar, (941) 455-9065 or Mark Benfield, (941) 263-6861



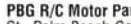
Ocala Radio Control Car Club, 3500 SE 30th Terrace, Ocala, FL 34471; Steve Shook, (352) 694-5147



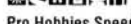
Paradise Speedway, Mile Marker 98.5 U.S. 1, P.O. Box 738, Key Largo, FL; Joe Ravard, (305) 451-3707



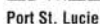
Paul's Stadium Raceway, 4511 W. Dr. M.L. King Jr. Blvd., Tampa, FL 33614; Paul Surette, (813) 872-8662



PBG R/C Motor Park, 6351 Barbara St., Palm Beach Gardens, FL 33418; Doug Gleason, (561) 743-9791 or Tim Case, (561) 627-2608



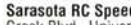
Pro Hobbies Speedway, 715 N. Lake Pleasant Rd., Apopka, FL 32712; (407) 886-4615



Port St. Lucie Racing, 3626 SW Rivera St., Port St. Lucie, FL 34953; Frank Spadavecchia, (561) 336-8711



River City R/C Car Club, 9711 Sharing Cross Dr., Jacksonville, FL 32257; Bill Fraden, (904) 268-1948



Sarasota RC Speedway, 8475 Cooper Creek Blvd., University Park, FL 34201; Jim Wilson, (941) 358-7047



South Daytona R/C Raceway, 2121 S. Ridgewood Ave., South Daytona, FL 32119; Mike Bean, (904) 426-6481



South Palm Beach Racers, South County Regional Park, West Boca Raton, FL 33486; Mike Fazio, (561) 338-5367



Superior Hobbies R/C Parking Lot Racing, 430 E. Hwy. 436, Ste. #106, Casselberry, FL 32707; Rob Michael, (407) 834-9299



Tallahassee R.C. Raceway, Tom Brown Park, Easterwood Dr., Tallahassee, FL 32311; Roland Costine, (904) 671-2814



Tampa Bay R/C Club, P.O. Box 10224, St. Petersburg, FL 33733; Dick Gillette, (813) 526-0744



Tampa Hobbytown R/C 4 Slot Car Raceway, 15702 N. Dale Mabry, Tampa, FL 33618; Max and Judy Rosenroth, (813) 968-7233

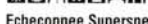


Winterset Raceway, U.S. Rt. 27 South, Winterset Motel, Sebring, FL 33872; John Bisbee or Mac Mixer, (941) 699-1140 or (941) 385-4448

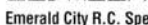


GEORGIA

Dallton Raceway, 2300 Chattahoochee Rd., Dalton, GA 30720; (404) 226-6699



Echeconnee Superspeedway, 2149 Richardson Dr., Macon, GA 31206; Andy Thompson or Cliff Kline, (912) 788-8731



Emerald City R.C. Speedway, Highway 40 East, East Dublin, GA; Terry Cook, (912) 272-3856



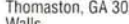
Hobby Town Raceway, 2301 Airport Thruway, Columbus, GA 31904; Frank Bastos, (706) 660-1793



HobbyTown Raceway, 225-B Tom Hill, Sr. Blvd., Macon, GA 31210; Marcus Lee, (912) 474-0061



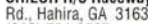
Lake Mayer Raceway, 1430 Dale Dr., Savannah, GA 31406; (912) 598-9709



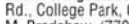
The Racer's Edge, 1530 Hwy. 19 N., Thomaston, GA 30286; Roger or Mark Walls



Sandy Cross Speedway, Rt. 1, Box 1071, Hwy. 51, Royston, GA 30662; Morris Phillips or Wayne Fowler, (706) 245-9573



SHILOH R/C Raceway, 6362 Shiloh Rd., Hahira, GA 31632; Doug Burnett, (912) 794-2507



Silver Wings Raceway, 5611 Riverdale Rd., College Park, GA 30349; M. Bradshaw, (770) 991-2225



Stinger RC Super Speedway, 3769 Maysville Rd., Commerce, GA 30529; Deric Sauls, (706) 335-5006 or (706) 335-9044



Sugar Bowl R/C Speedway, 5272 Nelson Brogdon Blvd., Sugar Hill, GA 30518; Shelley Bailey, (770) 945-6709



Valdosta Hobbies, 3998 Inner Perimeter Rd., Valdosta, GA 31602; Ron Hood, (912) 244-2101



HAWAII

Garden Isle R/C Racers, 5855 Ahakea St., Kapaa, Kauai, HI 96746; Arnold Morales, (808) 823-0856



Kakaako Water Front Park Dragway, 98-029 Hekaha St., Bay #32, Alea, HI 96701; James Inkyo, (808) 487-5155



Keehi Lagoon Park, Leeward Community College, Waipahu, HI 96797; (808) 676-5486



Maui R/C Racing Association, 430 Hookahi St., #13, Wailuku, HI 96793; Titech R/C Hobbies, Radio Control Association, (808) 244-0526



Pearl City Raceway, 98-029 Hekaha St., Bay 32, Alea, HI 96701; James Inkyo, (808) 487-5155



Radio Control Hawaii, 474 Kalanikoa St., S-104, Hilo, HI 96720; Glenn Shiroma, (808) 935-5629



Team PRC Racing Club, 176 Mamo St., Hilo, HI 96720; Charlie Kawamoto, (808) 935-3561

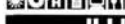


IDAHO

Capital Dirt Burners, 301 N. Bruce, Boise, ID 83712; Mike Ard, (208) 345-3806

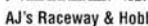


Dirt Stuff Plus, 5344 N. Yellowstone Hwy., Idaho Falls, ID 83401; Brian Krah, (208) 522-7576

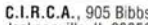


ILLINOIS

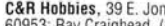
Adam's R/C Raceway, 7201 S. Adams Bartonville, IL 61607; Ray Tighe, (309) 633-9300



AJ's Raceway & Hobby, 10211 Keslinger Road, Dekalb, IL 60115; A.J. Schultz, (815) 756-2772



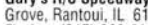
C.I.R.C.A., 905 Bibbs St., Jacksonville, IL 62650; Sport 'n' Hobby, (217) 245-1375



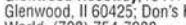
C&R Hobbies, 39 E. Jones, Milford, IL 60953; Ray Craighead, (815) 889-4073



Dan's Hobby World, 18415 S. Halsted St., Glenwood, IL 60425; Dan, Bruce or Josh, (708) 754-7988



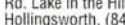
Gary's R/C Speedway, 1712 East Grove, Rantouli, IL 61866; Gary Dale Flesher, (217) 893-9297



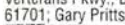
Glenwood Roseway, 18417 Halsted, Glenwood, IL 60425; Don's Hobby World, (708) 754-7988



G&R Raceway & Hobbies, 533 Bank Lane, Highwood, IL 60040; Randy Rose, (847) 432-9600



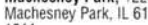
HobbyTown Raceway, 9346 Virginia Rd., Lake in the Hills, IL 60102; Mike Hollingsworth, (847) 458-1777



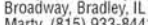
HobbyTown Raceway, 2103 N. Verterans Pkwy., Bloomington, IL 61701; Gary Pritts, (309) 664-4451



Leisure Hours R/C Raceway, 24121 N. Theodore, Bldg. 1, Plainfield, IL 60544; Scott Hill, (815) 439-1777 (track), (815) 439-1477 (shop)



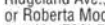
Machesney Park, 1220 Shappert Dr., Machesney Park, IL 61115; (815) 282-1311



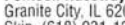
Marty's R/C Hobby, 1335 E. Broadway, Bradley, IL 60915; Gail or Marty, (815) 933-8441



Milety Motor Speedway, 1109 N. Bloomington St., Rte. 23, Streator, IL 61364; Doug, (815) 672-4212



Monee R/C Raceway, 26049 Ridgeland Ave., Monee, IL 60449; Roy or Roberta Moody, (708) 534-2422 (track), (708) 799-5597 (office)



Pontoon Raceway, 3670 St., Rte. 111 Granite City, IL 62040-4304; Pat or Skip, (618) 931-1206



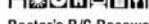
Outlaw R/C Speedway, 1614 Broadway, Mattoon, IL 61938; (217) 234-6229



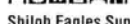
R/C Workshop, 3100 S.W. Adams St., Peoria, IL 61605; Al Kretz, (309) 673-4860



Radio-Active Raceway, 751 N. Bolingbrook Dr., #15, Bolingbrook, IL 60440; Jim, (630) 759-7557



Rector's R/C Raceway, RR 3, Box 104, Albion, IL 62806; Tim Wolfe, (618) 842-9379 (M-F), (618) 446-3282 (Sun.)



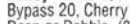
Shiloh Eagles Superspeedway, 308 N. Virginia Ave., Belleville, IL 62220; (618) 277-6030



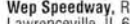
SIRCAR Raceway, 1200 N. Marion, Carbondale, IL 62901; (618) 549-5885



Stanton Hobby Shop, 4718 N. Milwaukee, Chicago, IL 60630; Kevin Kane, (773) 283-6446



Valley Farms R/C Raceway, 706 Bypass 20, Cherry Valley, IL 61016; Dean or Debbie, (815) 332-4516 or (815) 547-5984



Wep Speedway, RR #2, Box 44 Lawrenceville, IL 62439; Bill Poe



INDIANA

Bremen Racing Ent., 308 N. Bowen, Bremen, IN 46506; Dale Heuberger, (219) 546-3807



Dirt Slinger's Raceway, 546 North 12th Ave., Beech Grove, IN 46107; Phil Riley, (317) 787-3815



Elliott's R/C Raceway, 2140 North Plate, Kokomo, IN 46901; (765) 452-0163



G.R.C.C. Inc., 1651 W. Franklin St., Elkhart, IN 46516; Pete Russell, (219) 293-1827



Hardesty R/C Raceway, 11 East Plymouth St., Hamlet, IN 46533; Max Hardesty, (219) 867-8600



Hobby Barn Raceway, 1950 Springhill, Terre Haute, IN 47802-9694; (812) 299-5773



Hobbytown U.S.A., 5385 E. 82nd St., Indianapolis, IN 46250; Bill Scott, (317) 845-4106



Kokomo Hobby & Radio Raceway, 1108 E. Markland, Kokomo, IN 46901; (765) 457-5060



P&T Hobbies and Raceway, RR 2 (Hwy. 60), Mitchell, IN 47446; Paul Weber or Tom Logsdon, (812) 849-6666; email: pnthobby@kiva.net



Race Street Hobbies, 1126 1/2 Race St. New Castle, IN 47362; Jim Burke, (765) 521-4888



RC Barn, 310 N 125 W, Monroe, IN 46772; Mark Lengacher, (219) 692-6600



R.C.R.C. Raceway of Salina, 1300 E. Crawford, Bill Burke Park, Salina, KS 67401; Calvin Calp, (913) 823-9558



R/C World of Indiana, 2246 West U.S. Hwy. 36, Lynn, IN 47355; Joe Kolp, (765) 874-2464; e-mail: rcworld@globalsite.net



R/C Mania, 8 Wood Ct., Hebron, IN 46341; Ron Trobaugh, (219) 996-6288 (shop); (219) 762-5365



The Rink, 7900 Whitcomb, Merrillville, IN 46410; Don Reiner, (219) 769-8113



Rod's Off-Road R/C Track, 800 N. Division, Bristol, IN 46507; Rod Harms, (219) 848-7848



IOWA

Delb's Speedway, 423 11th Ave. So., Clinton, IA 52732; Rusti's Miniatures and Hobbies, (319) 243-2697



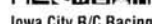
Dubuque R/C Speedway, Dubuque County Fairgrounds, Dubuque, IA 52001; Paul Conlon, (319) 556-2736



Hobby Haven, 7672 Hickman Rd., Des Moines, IA 50322; Rick Marble, (515) 276-8785



Inside Challenge, 2028 Main St., Keokuk, IA 52632; Jessie, (319) 524-2225



Iowa City R/C Racing Association, 1700 First Avenue, Iowa City, IA 52240; Hobby Corner; (319) 338-1788; fax (319) 354-6105



IROAR—Hawkeye Downs Raceway, Hawkeye Downs, 6th St. S.W., Cedar Rapids, IA 52404; Dave Kleinschrodt, (319) 556-8524



Manly R/C Club, Box 23 (Hwy. 65), Manly, IA 50456; Bruce Hill, (515) 454-2025



Marble's Raceway, 4685 SE 40 St., Des Moines, IA 50317; Rick Marble, (515) 262-7507



Mr. Car Raceway, P.O. Box 1112, Central Iowa Fairgrounds, Marshalltown, IA 50158; Jim Gossett, (515) 483-2234

Rick's Hobby Farm, 2089 Park Rd., Hawesville, KY 42348; Rick Early, (502) 927-8527

LOUISIANA

Trio Hobbies & R/C, 216 Redmar Plaza, Radcliff, KY 40160; Maurice Johnson, (502) 351-7547

MAINE

Al's R/C Store, 1529 Anita, Sulphur, LA 70663; Al Gaspard, (318) 625-5880 or (318) 437-8545

Baton Rouge Velodrome, 7122 Perkins Rd., Baton Rouge, LA 70815; Weldon Sharon, (504) 665-5616; open Sunday 10-4.

Indy Speedway & Hobby, 3753 General DeGaulle Dr., New Orleans, LA 70131; Vince Sheetz, (504) 367-1891

Pontchartrain Hobby Shop, 3755 Pontchartrain Dr., Slidell, LA 70458; (504) 649-1199

MAINE

Clay Bowl R/C Hobbies, P.O. Box 61, Greene, ME 04236; Pat Cap, (207) 946-5003

R/C Speedway & Hobbies, 87 Main St., Fairfield, ME 04963; David Prescott, (207) 453-4588

MARYLAND

Cockeysville Astrodome Racers, 10854 York Rd. (rear), Cockeysville, MD 21030; Steve Balaz, (410) 666-2521

Counterside Raceway (portable), 406 Pamela Rd., Apt. C, Glen Burie, MD 21061; M&J's Promotional Entertainment, (410) 761-6196

Doug's Raceway, 2935 Crain Hwy., Waldorf, MD 20601; Doug Moran, Jr., (301) 843-6220

Dusty Downs, 4665 Bethlehem Rd., Preston, MD 21655; Frank Show, (410) 673-2191

Hobby Town USA, 8223-11 Elliot Rd., Easton, MD 21601; Bill Dyke, (410) 820-9308

J.R.'s Race Place, 2935 Crain Hwy., Waldorf, MD 20601; James Radford, (410) 947-2766

The Track, 16806 Oakmont Ave., Gaithersburg, MD 20877; Mimi Wong, (301) 417-9630

MASSACHUSETTS

C&C Hobby & Raceway, 562 Russells Mills Rd., So. Dartmouth, MA 02746; Charlie, (508) 997-4131

Hi-Tech Hobbies, 1681 Broadway (Rt. 138), Raynham, MA 02767; Ruben, (508) 880-5373

Megadrome Raceway, Rt. 8 Curran Hwy, North Adams, MA 01247; Bob Blanchette, (413) 743-7223

Northboro Speedway, 168 Main St., Rte. 20, Northboro, MA 01532; Bob Trimble, (508) 393-8087

MICHIGAN

Down River R/C Association/Riders, 1519 Oak St., Wyandotte, MI 48192; Dave McCaslin, (313) 287-7405 or (313) 284-1560

Freedom Hill R/C Raceway, 29330 Coolidge, Roseville, MI 48066; Curley Grew, (810) 776-5483

Hobby Hub, 5859 M99, Diamondale, MI; Verne Goebble, (517) 337-9278 or (517) 351-5843

MINNESOTA

Northwoods Hobby Raceway, 2635 Hwy 25 North, Brainerd, MN 56401; Tom Grogg, (218) 829-9257

House of Hobbies, 2863 West Shore Dr., Holland, MI 49424; (616) 786-3686

JT Superspeedway, W. Golden Ave., Battle Creek, MI; Jerry or Sam, (616) 965-0116

Larry's Performance R/C's, 43665 Utica Rd., Sterling Heights, MI 48310; Larry, (810) 997-4840

MCRC Raceway, 4601 Page Ave., Michigan Center, MI 49203; Sam Sprang, (517) 787-9161

Newberry R/C Raceway, RR #3 Box 2860, McMillan, MI 49853; Dustin Hart, (906) 293-3044

Northwest Michigan R/C Club 744 Munson Ave., Traverse City, MI 49686; Jim Ovaatt, (616) 947-6670

Raw Roots Race Tracks, 8916 Pine Lake Place, West Olive, MI 49460; Roy Bennink (616) 399-9338, or Larry Welsh, (616) 786-2401

R&L Hobbies & Racing, 9782 Portage Rd., Kalamazoo, MI 49002; Rex Simpson, (616) 323-3686; fax (616) 329-1744

Rodgers R/C Raceway, 7463 Ridge Rd., Britton, MI 49229; George Rodgers, (517) 451-8301

Thumb Raceway, 3441 Main St., Marquette, MI 49853; Jim Wilson, (517) 635-7848

UCLA Hobbies, 2190 Clear Lake Rd., West Branch, MI; Bob Ruzanski, (517) 345-8018; fax (517) 345-8018

USA Raceways, 6083 Dixie Hwy., Bridgeport, MI 48722; Dave Killingsworth, (517) 777-7054

Vicksburg Off-Road R/C Raceway, 50201 Silver St., Vicksburg, MI 49097; Jeff Schroeder, (616) 215-8591

Village Hobbies-n-Crafts, 195 N. Elm, Hesperia, MI 49421; Alan or Fran, (616) 854-1374

Village R/C Raceway, Prairie Ronde St., Decatur, MI 49045; Chuck Nolk, (616) 423-7878

West Michigan R/C Racers Club, 814 E. Railroad St., Hastings, MI 49058; Doug, (616) 948-2287 or Pat, (616) 945-3873

Westside R/C Raceway, 4335 Lake Michigan Dr., Grand Rapids, MI 49504; George Oriikowski, (616) 791-9902 (Open May through December)

Duey's Hobbies & R/C Raceway, 6600 Cahill Ave., Inver Grove Heights, MN 55076; Duey Carlson, (612) 450-1721

Grand Rapids R/C Speedway, 2209 Hwy 2 East, Grand Rapids, MN 55744; Aaron Voegs, (218) 326-6751

Greater Minnesota Racine Place, 3302 Southway Dr., St. Cloud, MN 56301; Jon Jackson, (320) 252-9768

J's R/C Raceways, Rte. 2, Box 266, Starbuck, MN 56381; Jay Campbell (320) 239-4827

Minn-E-Golf & Hobby, 9100 Park Ave., Elk River, MN 55330; (612) 441-8365

Northwoods Hobby Raceway, 2635 Hwy 25 North, Brainerd, MN 56401; Tom Grogg, (218) 829-9257

Paul Bunyan Raceway, Rte. 1, Box 468, Bemidji, MN 56664; Brad Trask, (218) 243-2749

Ray's Raceway Park, 105 3rd Ave. NE, Glenwood, MN 56334; Dan Winter, (320) 634-5246

R/C Racing World, 235 Main Ave. North, Harmony, MN 55939; Mark McKay, (507) 886-5931 or (507) 886-2224

Southside Speedway, 2241 Marion Rd. SE, Rochester, MN 55904; Kevin Guy, (507) 281-3233

Time R/C Raceway, 20 West Lake St., Chisholm, MA 55719; RV, (218) 254-4321

Trackside Racing, 443 8th Ave. NW, New Brighton, MN 55112; Winton Offelle, (612) 633-2112

Wild West R/C Speedway, 2822 Piedmont Ave., Duluth, MN 55811; Roger Deloach, (218) 727-6248

Fast Freddy's Raceway, 20390 Hwy. 49, Saucier, MS 39574; Mark Payne, (601) 832-0315

Joe McFadden Hobbies, 1619 51st Ave., Meridian, MS 39307; Joe McFadden, (601) 483-7000

Small Cars Unlimited, 820 Cooper Rd., Jackson, MS 39212; (601) 372-FAST

All Seasons Hobby, 152 O'Fallon Plaza, O'Fallon, MO 63366; Bob Daniels, (314) 281-8767

B&L Hobbies & Raceway, 2800 Anchor Dr., Park Hills, MO 63061; Bob Marler, (573) 431-9444

Blue Vue Speedway, 12019 E. 47th St., Kansas City, MO 64133; Mark Randol, (816) 358-0238

Columbia R/C Trax, 1502 W. Bus Loop 70 (Exit 125), Columbia, MO 65202; Gary Phillippe, (573) 682-3993

Fire Mountain Raceway, 8647 Commercial Blvd., Pevely, MO 63070; Dan Gordon, (314) 475-6449

Greentree R/C Racepark, St. Louis Dirt Burners R/C Club, Marshall Rd., Kirkwood, MO, (314) 831-2194

Ozark Mountain Speedway, Rt. #2 Box 50, H-Highway and County Rd. 31, Noel, MO 64854; Clayton Younker (417) 475-6222

Ozarks R/C Raceway, Hwy 13N, Brighton, MO 65761; Gene Rhodes or Ron Hawkins, (417) 742-4376 or (417) 742-7223

North Missouri Raceway, 223 Graves St., Chillicothe, MO, Billy Johnston, (816) 646-1120

Real Blue Vue Speedway, 24204 State Rt. 58, Pleasant Hill, MO 64080; Steve Hale, (816) 540-5584

Wilson's R.C. Speedway, 204 Southwest Dr., Kennett, MO 63857; Keith Wilson (573) 888-9223

Stormer Raceway & Slot Motorplex, P.O. Box 126 Hwy. 2 East, Glasgow, MT 59230; (406) 228-4569

Jefferson Speedway, 5494 Berkshire Valley Rd., Oak Ridge, NJ 07438; (201) 697-7525

Golden Hobbies Raceway, 415 Erial Rd., Pine Hill, NJ 08021; John or Iona Golden, (609) 782-1222

Family Hobbies Raceway, 3576 N.W. Blvd. & Weymouth Rd., Vineland, NJ 08360; Linda Vogel, (609) 696-5790

Golden Hobbies Raceway, 415 Erial Rd., Pine Hill, NJ 08021; John or Iona Golden, (609) 782-1222

Jefferson Speedway, 5494 Berkshire Valley Rd., Oak Ridge, NJ 07438; (201) 697-7525

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Jefferson Speedway, 5494 Berkshire Valley Rd., Oak Ridge, NJ 07438; (201) 697-7525

NEBRASKA

Goodyear Superspeedway and Off-Road, 4021 North 56th, Lincoln, NE 68510; Tom or Bob, (402) 464-5000

Hactor R/C Raceway, 55192 849th Rd., Norfolk, NE 68701; John Schoenauer, (402) 644-7922

Mr. Bill's, 450 West 2nd St., Hastings, NE 68901; Bill J. Ries, (402) 462-4865

O.N.R.O.A.D., 3307 N. 58 St., Omaha, NE 68104; Cook Jacobs, (402) 556-8674

OTWG Carpet Raceway, 55129 849th Rd., Norfolk, NE 68701; John Schoenauer, (402) 644-7922

RC Motorsport Off-Road Raceway, 5600 Mass Rd., Papillion (Omaha), NE 68133; Marty Stepanek, (402) 593-6133

Salvation Army South Corps, 4032 Harrison St., Omaha, NE 68164; James Frye, (402) 734-3414; fax (402) 734-3415

Siouxland R/C Car Association, 1800 Dakota Ave., South Sioux City, NE 68776; Jeff, (402) 494-1525

Winners' Circle, 3368 N. 88th Plaza, Omaha, NE 68164; Robert Conner, (402) 571-1821

NEVADA

Dansey's Indoor R/C & Hobbies, 741 N. Nellis, Las Vegas, NV; David Lugo, (702) 453-RACE

Silver State RC Club, 400 South Saliman #33, Carson City, NV 89701; Michael Geist, (702) 884-0375

Western R/C Raceway, 6404 Richmar, Las Vegas, NV 89139; Randy Grigg, (702) 260-9222

NEW HAMPSHIRE

Axis Racing R/C Dragway, 4197 High St., Hampton, NH; Dan Peterson, (603) 926-5211

Economy R/C Speedway, 4 Maple St., Winchester, NH 03470; Harold Thomas, (603) 239-4482 or 239-6470

Open Season Sports Center, Rt. 302, Lisbon Rd., Lisbon, NH 03585; Joseph Wiggert, (603) 838-6602

Robert's Railroad & Hobbies, 1335 1st NH Turnpike—Rt.4, Northwood, NH 03261; Robert M. Jeffers, Jr., (603) 942-7659

RT 106 Racepark, 743 Clough Mill Rd., Pembroke, NH 03275; Douglas Graves, (603) 224-RACE

NEW JERSEY

America's Hobby Center Inc., 18300 Tonnelle Ave., North Bergen, NJ 07047; John Many, (201) 662-0777

Ray's American Raceway, 142 Wilson Ave., Englishtown, NJ 07726; Ray Whitehead, (908) 446-3737

Family Hobbies Raceway, 3576 N.W. Blvd. & Weymouth Rd., Vineland, NJ 08360; Linda Vogel, (609) 696-5790

Golden Hobbies Raceway, 415 Erial Rd., Pine Hill, NJ 08021; John or Iona Golden, (609) 782-1222

Jefferson Speedway, 5494 Berkshire Valley Rd., Oak Ridge, NJ 07438; (201) 697-7525

Golden Hobbies Raceway, 415 Erial Rd., Pine Hill, NJ 08021; John or Iona Golden, (609) 782-1222

Jefferson Speedway, 5494 Berkshire Valley Rd., Oak Ridge, NJ 07438; (201) 697-7525

Golden Hobbies Raceway, 415 Erial Rd., Pine Hill, NJ 08021; John or Iona Golden, (609) 782-1222

Jerry's Hobby Center & Raceway, 336 Rt. 22W, Greenbrook, NJ 08812; Jerry or Gary, (908) 752-6030

LBRA Track, 392 Warburton Pl., Long Branch, NJ 07740; (908) 222-5122

Millville R/C Oval, 114 N. High St., Millville, NJ 08332; William Denstoz, (609) 327-4640

Pit Stop Dragway, 100 Campus Rd., Totowa, NJ 07512; Kimberly Frank, (201) 956-7223

On Trax Hobbies, 1549 Rte. 70, Browns Mills, NJ 08015; Joseph DiGirolamo, (609) 735-0422

R/C Shag Arena, 690 Jendi Pkwy., Totowa, NJ 07513; Amber Beggall, (201) 956-7223

South Jersey Cost Controlled Racing, 25 Jackson Lane, Sicklerville, NJ 08081; Ray Murray, (609) 629-4809

The Race Place, 1151 Hwy. 33, Farmingdale, NJ 07731; John Fary, (908) 938-5215

NEW MEXICO

Meerscheidt R/C Raceway Park, Meerscheidt Recreation Center, Walnut and Hadley by BMX, Las Cruces, NM 88005; Robert Heinsen (505) 526-6856 or Jim Meerscheidt (505) 523-2995; email MEERSCH@aol.com

NEW YORK

BarnStormers, MD #1 Old Oxford Rd., Chester, NY 10918; Lou, (914) 469-8206

Beach Hill Speedway, 1760 Beach Hill Rd., Watkins Glen, NY 14891; Jim Riley, (607) 535-2616

Brian's Off-Road Track, 1124 N. Forest, Williamsville, NY 14221; Brian Was, (716) 633-8155

Brookport Speedway, 6000 Sweden Walker Rd., Brookport, NY 14420; Gil & Betty Glidden, (716) 637-6224

Brownie's Pro & Sport Hobbies, 124 Bennett St., Staten Island, NY 10302-1426; John Brown, (718) 727-2194

Bruckner Racing, 2908 Bruckner Blvd. Bronx, NY 10465

Thomas Baffers Sr., (800)-288-8185

BSK Hobbies & Raceway, 120 Main St., Hometown, NY 14843; Bruce Harris, (607) 324-4011, (800) 603-0197

C&D Raceway, 12542 NYS Rte. 12E, Chaumont, NY 13622; Chris or Don Bourquin, (315) 649-5403

Capital District R/C Racers, 27 Venus Dr., Albany, NY 12205; Keith Green, (518) 783-8036

Chipmunk Hill R/C Speedway, 217 Pine St., Theresa, NY 13691; Ted or Pete House, (315) 628-5065

Foothills R/C Speedway, 3200 Chestnut St., Oneonta, NY 13820; Dave Osterhoot, (607) 432-5098

Frogtown Hobbies, Rt. 37, Mini Pines Village, Hopansburg, NY 13655; Dennis White, (518) 358-3686

Hacr's Hobbies & Raceways, 120 Cayuga St., Canal View Mail, Fulton, NY 13069; Jack LaTulip, (315) 598-7063

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Hobby Images R/C Raceway, 89 Jerusalem Ave., Hicksville, NY 11801; Chris LaRussa, (516) 822-8259
AACEB

Jerry's Raceway, 111 S. Applegate Rd., Ithaca, NY 14850; Jerry and Lori Achilles, (607) 277-0940
AACEB

LI 1/4-Scale Racers, 63 Horton Dr., Huntington Station, NY 11746; (516) 351-5384
AACEB

Long Island Raceway, 168 Broad Hollow, Farmingdale, NY 11735; James, (516) 845-7223
AACEB

The Model Shop, 1 Lakewood Ave., Monticello, NY 12071; Richard Ciminoli, (914) 791-6075
AACEB

Performance Plus Radio Control Speedway/The Hobby House, 1141 1/2 Jones & Gifford Ave., Jamestown, NY 14701; (716) 488-1772
AACEB

P.R.O. Speedway, 5 Washington St., Cattaraugus, NY 14719; Marc Pritchard, (716) 257-3101
AACEB

Radio Hill Raceway, 1219 Shannon Corners Rd., Dundee, NY 14837; Bill Brewer, (607) 243-8641
AACEB

Rampage R/C, 27 Fuller Lane, Hyde Park, NY 12538; Brian Walker, (914) 229-1379; (914) 229-2456
AACEB

R/C Competition Corner, 2413 Brewerton Rd., Mattydale, NY 13211; Lori and Cos Cirriello, (315) 455-8718
AACEB

R/C Sport Hobby, 69-57 Juniper Blvd. South, Middle Village, NY 11379
AACEB

R&S Hobbies, 356 Macedon Ct. Rd., Fairport, NY 14502; (716) 425-3722
AACEB

Ringwood Junction, 1922 Dryden Rd., Freeville, NY 13068; Steve Miller, (607) 347-4198
AACEB

Schoharie Co. R/C Car Club, P.O. Box 126, Cobleskill, NY 12043; (518) 922-6982
AACEB

Southern Tier Raceway, 88 Paige St., Owego, NY 13827; Anita Harding, (607) 687-5395
AACEB

South Shore Hobby & Raceway, 464 East Main St., Patchogue, NY 11772; Benny or Bonnie, (516) 758-5567
AACEB

Tri County Remote Control Car Club, 33 West Decker St., Johnstown, NY 12095; Jim Sprouse, (518) 762-8884
AACEB

Tri-state Area Radio Control Model Auto Club (TARMAC), 28/30 Mountain View Rd., Poughkeepsie, NY 12603; Todd (914) 342-5409; tracksite (914) 454-8276
AACEB

Walt's Hobby, 2 Dwight Park Dr., Syracuse, NY 13209; (315) 453-2291
AACEB

Westfield R.C. Speedway, 27 Clark St., Westfield, NY 14787; John or Jared Lindstrom, (716) 326-2339
AACEB

Whitestone, 30-56 Whitestone Expy. (Dept. of Motor Vehicles), Flushing, NY 11374; Rudolf Ardilla, (718) 966-6155
AACEB

ZDAR Road Speedway, 15318 Armes Ct., Gowanda, NY 14070; David & Gordon Ackler, (716) 532-9463
AACEB

NORTH CAROLINA

A&J R/C Models, 2051 Anthony Rd., Burlington, NC 27215; Jerry Loye or Andrea Thompson, (910) 227-4556; fax (910) 227-1001
AACEB

Another Zito's Mobile MASCARR Inc., 412 E. Blume St., Landis, NC 28088; Carmen Esposito or Pat Youngerman, (704) 451-3293
AACEB

The Antique Barn, 2810 Forest Hills Rd., Wilson, NC 27893; Steve Seidlinger, (919) 237-6778
AACEB

Atlantic Coast R.C., 8-A Lockhead Ct., Greensboro, NC 27409; Charlie Higgins or Harry Johnson (910) 664-1277
AACEB

Badin Shore Raceway, 1730 Jackson Lake Rd., High Point, NC 27263; Jimmy or Tim Martin, fax (910) 431-6407
AACEB

C/C Hobby Speedway, 8358 U.S. Hwy. 220 Bus. N., Randleman, NC 27317; Steve & Mary Cox, (910) 495-3482
AACEB

C&H Raceway, 1400 N. Cannon Blvd., Kannapolis, NC 28083; Camera & Hobby Shop, (704) 933-5321
AACEB

Cape Fear Speedway, 207 Harley Rd., Wilmington, NC 28401; Bob Justice, (910) 452-2354
AACEB

Carolina Dragway, 907-D Warsaw Rd., Clinton, NC 28328; (910) 592-4569
AACEB

Chatham R/C Raceway, 326 Reno Sharpe Store Rd., Bear Creek, NC 27207; Dwight Fields, (919) 898-2991
AACEB

Green Flag RC Raceway, 107 Harley Rd., Wilmington, NC 28401; Mike McLemore, (910) 397-0676 or (910) 452-1620
AACEB

Hobby Club R/C Raceway, 1241 Buck Jones Rd., Raleigh, NC 27606; Hobby Club, (919) 460-8838
AACEB

King R/C & Super Speedway, 143 Industrial Dr., P.O. Box 897, King, NC 27021; Chris Smith, (910) 983-5598 or (910) 883-3969
AACEB

Ride & Slide R/C Raceway, 5319 Yadin Rd., Fayetteville, NC 28303; Jim Woodman, (910) 425-5276 or Bill Culbertson, (910) 867-4202
AACEB

R&J Off-Road Racing, 6172 Blalock Rd., Lucama, NC 27851; Robert Williams, (919) 239-0853 or Jonathan Jenkins, (919) 746-2703
AACEB

Radio Jockey's Parkway, "RJ's," Rt. 9, Box 651, Fay, NC 28301; Tony Stirling, (910) 486-4820
AACEB

Rosewood R/C Speedway, 651 Community Dr., Goldsboro, NC 27530; Glenn Elam, (919) 731-4734
AACEB

Southern RC Motorsports Club, Hwy. 17S, Shallotte, NC 28459, P.O. Box 1651; Mark Whitt, (910) 754-4902 or Eddie Ferster, (910) 754-8528
AACEB

Ultratrac, 5505 Palmers Branch, Leland, NC 28451; Mike Williams, (910) 313-0350
AACEB

NORTH DAKOTA

Hacienda Hills Speedway, 20 Hacienda Hills, Minot, ND 58701; Kenny Duchscherer, (701) 839-4419
AACEB

Northern Mini Racers, P.O. Box 415, Minot, ND 58702; Roger Lee, (701) 839-5294
AACEB

River City R/C, 2714 Main Ave., Fargo, ND 58103; Chris Hughes, (701) 235-1272
AACEB

Surrey International Raceway, RR 1, Box 37, Norwich, ND 58768; Marlen Lenton, (701) 728-6760
AACEB

OHIO

Aerotech Raceway, 409 Applegrove Rd., North Canton, OH 44720; (330) 499-1300
AACEB

Canton R/C Raceway, 2206 13th St. NE, Canton, OH 44705; Dan Mauger, (330) 833-3091
AACEB

Classic Hobbies, 1994 E. Waterloo Rd., Akron, OH 44312; Walt Ellis, (216) 733-6400
AACEB

CR Raceways Emporium, 323 Center St., Ashtabula, OH 44004; Virginia Gagat, (216) 992-3833
AACEB

CORCAR/Sams Club, 128 Amity Rd., Galloway, OH 43119-8732; Bill Stevenson, (614) 870-7159
AACEB

Columbus R/C Racing Club (C.R.C.R.C.), Franklin County Fairgrounds, Hilliard, OH 43026; Jeff Crowell, (614) 236-1783
AACEB

D&D Hobby Center, 1344 Lexington Ave., Mansfield, OH 44907; Eric Radio (419) 756-9771
AACEB

D&J R/C Raceway, 801 W. Market St., Orrville, OH 44667; Don Yoder or Mark Nussbaum, (330) 682-4266
AACEB

Fun for All Raceway, 675 College Dr., Batavia, OH 45103; Steve Donaldson, (513) 732-0440
AACEB

Greentown R/C Raceway, 3353 Perrydale, Greentown, OH 44630; Chuck Lambert, (330) 364-6585
AACEB

Hobby Shop Raceway, 2096 Miami Blvd., Centerville Rd., Centerville, OH 45459; The Hobby Shop, (937) 436-6161
AACEB

Hobby World, 3499 SR 59, Ravenna, OH 44266; Tom Fry, fax (330) 296-0894
AACEB

Lafferty R/C Raceway, Box 153, 70228 Hurrah St., Lafferty, OH 43951; Chris Christman, (614) 968-4818
AACEB

Lakes Hobbies, 3425 Manchester Rd., Akron, OH 44314; Roy Spencer, (330) 645-6912
AACEB

Medina R/C Raceway, 754 N. Court St., Medina, OH 44226; Bill Aholt, (216) 723-0255
AACEB

Mid American Raceway, 13150 Airport Hwy., Swanton, OH 43558; Bill or Chuck, (419) 475-9459
AACEB

Performance R/C Club of Ohio, 2206 13th St. NE, Canton, OH 44705; Greg Ledbetter, (216) 453-7089
AACEB

Scooters Hobby Hut, 234 Robbins Ave. #D, Niles, OH 44446; Dave "Scooter" Evans, (216) 544-9411
AACEB

Shiray's Hobby & RC Raceway, 19930 State Route 117, Waynesfield, OH 45896; Ray Zimmerman, (419) 568-8055
AACEB

TARCAR, 7216 Nebraska Ave., Toledo, OH 43617; Bill Bridges, (419) 826-3859
AACEB

Tri-State R/C Auto Racers, Joyce Park, Hamilton, OH; Ernie Bauhoffer, (513) 528-2052
AACEB

Van Wert R/C Raceway, 144 E. Main St. (above Hoverman Music), Van Wert, OH 45891; Mark Davis, (419) 232-2112
AACEB

Y-City Hobby & Speedway, 120 S. 6th St., Zanesville, OH 43701; Kevin McKenna, (614) 455-3025
AACEB

OKLAHOMA

Adams Creek R/C Speedway, 5207 S. 194th E. Ave., Broken Arrow, OK 74014; John Beighle, (918) 355-1416
AACEB

Competition R/C, 100 SE 89th, Oklahoma City, OK 73149; James or Louise Brown, (405) 634-0809
AACEB

Coweta Hobby & Speedway, 310 S. Broadway, Coweta, OK 74429; Deriald Seabolt, (918) 486-3948
AACEB

R/C Speedway, 1401 N. Vanburan, Enid, OK 73701; Sean or Jessica Hillery, (405) 237-5504
AACEB

Remote Control Race Course, 400 S. Vermont Ave., Ste. 104, Oklahoma City, OK 73108; Rick or Steve, (405) 947-RACE
AACEB

Wild Country Speedway, 127 South Main, Porter, OK 74454; Charles McCollough, (918) 685-0372 or (918) 687-1686
AACEB

OREGON

Competition Racing Association, 17941 NE Gleason, Portland, OR 97230; Mark Taylor, (503) 761-1334
AACEB

D.I.R.T. (Diamond International Race Track), 65540 73rd St., Bend, OR 97701; Daleyne and Edward Giletz, (541) 388-2932 or 1-800-475-6040, ext. 777
AACEB

Junior Vehicle Speedways, 3634 Table Rock Rd., Medford, OR 97501; (541) 664-7810
AACEB

Pit Stop Hobby, 634 N. Coast Hwy., Newport, OR 97365; Richard Wood, (541) 265-2825
AACEB

R/C Craze Speedway, 300 Ashland Lane, Ashland, OR 97520; Shawn Lazareff, (541) 482-4786
AACEB

R/C Plus Hobbies Raceway, 1857 25th St. SE, Salem, OR 97302; Ron Smith, (503) 364-9188
AACEB

R/C Speed Center, 2810 N. Pacific Hwy., Medford, OR 97501; Gene and Betty Jean Skelton, (541) 779-8298
AACEB

Yamhill County R/C Car Club, 722 Morgan Ln., McMinnville, OR 97128; Larry Rucker, (503) 472-7234
AACEB

PENNSYLVANIA

A&D's Bumps & Jumps, RR7, Box 7395C, Stroudsburg, PA 18360; Dan Ambrosio, (717) 424-1750
AACEB

A&E Raceway, Latrobe 30 Piz., Latrobe, PA 15650; Bruce Parker, (412) 539-7130
AACEB

Bachman's Speedway & Hobbies, Box 306, Effort, PA 18330-0306; Jeffrey Bachman, (610) 681-5845
AACEB

Benders Junction Speedway, 2300 Benders Dr., Bath, PA 18014; Gerald Wambold Jr., (610) 759-0161
AACEB

Brookville Hobby Shop, 170 Main St., Brookville, PA 15825; Mark Tonell, (814) 849-7385
AACEB

CEB Motors R/C Div., 5743 Molly Pitcher Hwy., Marion, PA 17235; Charlie Booze, (717) 375-4635
AACEB

Columbia Racing Association, 128 N. Front St., Philipsburg, PA 16866; Lurch Hammal, (814) 342-7114
AACEB

Cooks Way Raceway, Cook's Way, Mt. Pleasant, PA 16666; Bob Rhodes, (412) 547-5719
AACEB

Cressona Mall Speedway, Rt. 61, Pottsville, PA 17901; (717) 385-3506
AACEB

OC Ultra Trax, 13 York Rd., Wycombe, PA 18974; David Cowan, (215) 672-5200
AACEB

Dreamboat Hobbies, 2810 Pennsylvania Ave. W., Warren, PA 16365; Louie Dussia, (814) 723-8052
AACEB

Fantasy RC's and Hobby, 2315 W. 12th St., Erie, PA 16505; Frank Francis, (814) 453-6337
AACEB

Hipkin's Hobbies, 402 W. Avondale Rd., West Grove, PA 19390; Doug, (610) 869-8585
AACEB

Hobby America Raceway, 5 Fitzsimmons St., Duke Center, PA 16729; Dan or Mike Coast, (814) 966-3765
AACEB

Kontz's Home & Hobby Center, 12205 Hoover St., Pittsburgh, PA 15204; (412) 331-3866
AACEB

Kranzel's R/C Raceway & Hobbies, 415-B Bosler Ave., Lemoyne, PA 17043; David or Stuart Kranzel, (717) 737-7223
AACEB

Little Plum R/C Hobbies, RR 1 Box 330, Lock Haven, PA 17745; Larry Duck, (717) 769-1984
AACEB

Lugnut Raceway, 1713 Bethlehem Pike, Hatfield, PA 19446; Bill Henning or Kathy Anderson, (215) 822-5831
AACEB

Marshall's R/C Raceway, RR 4, Box 640, Honesdale, PA 18431; Bill or Dot Marshall, (717) 729-7458
AACEB

The Mushroom Bowl, 960 W. Cypress St., Kennett Square, PA 19348; Bruce or Drew, (610) 444-1850
AACEB

Pinion Twisters, 3M Plant, Green Ln. and Mitchell, Bristol, PA; Mark, (215) 632-2344 or Tony, (215) 742-3560
AACEB

Pit Stop Hobbies, 262 W. Main St., Mount Joy, PA 17552; James Stoudt Jr., (717) 653-6222
AACEB

Prop & Wheels Raceway, 139 W. Broad St., Tamaqua, PA 18252; Gil Walters, Prop & Wheels Hobbies, (717) 668-2288
AACEB

The Raceway at River Junction, 1216 4th St. (behind cemetery), Beaver, PA 15009; (412) 728-5571
AACEB

RC Ave. Raceway, 324 McKinley Ave., Latrobe, PA 15650; Scott Smith, (412) 537-5501
AACEB

RC Outfitters RCO Raceway, 519 Broadway, Hanover, PA 17331; Chris Shaffer, (717) 633-9490
AACEB

R/C Pro Speedway, Millville Rd., Bloomsburg, PA 17815; John Swisher, (717) 387-0266; fax (717) 387-4937
AACEB

R/C Pro III, 910 Chestnut St., Coal Twp. (Shamokin), Shamokin, PA 17866; John Swisher, (717) 648-7763
AACEB

Riverside Raceway, PA Ave. W & Hickory, Warren, PA 16365; Jeff, (814) 723-4211
AACEB

S.A. Hi Banks, Hahn's Dairy Rd., Palmerton, PA 18071; Scott Andrews, (610) 826-4583
AACEB

Sinking Spring Race Center, 237 South Hull St., Sinking Spring, PA 19608; Randy Gelsinger, (610) 670-0760
AACEB

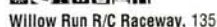
Staub Bros. R/C Speedway, 31 Locust St., Gettysburg, PA 17325; Todd or Scott Staub, (717) 334-5445
AACEB

TnT Raceway, Randolph Rd., Great Bend, PA 18821; Frenchie, (607) 775-1750 or Ed Kraft, (717) 967-2604
AACEB

Trains & Lanes Raceway, 3825 Northwood Ave., Easton, PA 18045; Jeff Setzer, (610) 253-8850 (800) 447-4891



Willow Mill Speedway, 37 N. Season's Dr., Dillsburg, PA 17019; George Verbovitz, (717) 432-4445



Willow Run R/C Raceway, 135 Wright St., Corry, PA 16047; Jim Small, (814) 664-8147



World A.T.L.A.S./P.A.R.C.E. R/C Raceway Hobby Shop & R/C Club, Chester Exchange Mall, 10th & Morten St., Chester, PA 19013; Darryl, Lee or Marc, (610) 874-2540



PUERTO RICO

Cindra R/C Track, Carr 7787 KM 1.6, Bo Beatriz Adentro, Cidra, Puerto Rico 00739; Humberto (Tito) Lizardi, (787) 739-1532



Dorado Offroad R/C Track, Pista Atletica Bo. Higuillar, Dorado, Puerto Rico 00646; Roberto Lamoso/Jaime Ramos, (809) 796-5603 or (809) 796-1734



Hacienda Muñoz R/C Track, Carr. #14, Juana Diaz, PR 00795; (809) 837-7083



RHODE ISLAND

SK Hobbies Inc., 15 Carl St., Johnston, RI 02919; Slim or Keith, (401) 453-1440



Tri-State R/C Raceway, 205 Hallene Rd., Warwick, RI 02886; Raymond Dean, (401) 738-4908

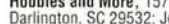


SOUTH CAROLINA

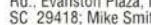
Extreme R/C Raceway, 5976 Grace Lane, Myrtle Beach, SC 29577; Kevin Bullock, (803) 236-2083



The Grove Racing Center, 939 S. Anderson Rd., Rockhill, SC 29730; Mike Durham or Don Faris, (803) 327-4121



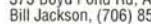
Hobbies and More, 1570 S. Main St., Darlington, SC 29532; Jerry Pollard, (803) 393-0355



J&M R/C Hobbies, 5341 Dorchester Rd., Evanston Plaza, N. Charleston, SC 29418; Mike Smith, (803) 552-9449



Midway Hobby and Raceway, 707 Sulphur Springs Rd., Greenville, SC 29611; Allen A. Dodson, (864) 246-6335



ORA Atomic Racing Facility, 373 Boyd Pond Rd., Aiken, SC 29803; Bill Jackson, (706) 855-0846 or (803) 642-0314

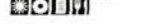


SOUTH DAKOTA

Action R/C Raceway, 107 N. Main, Mitchell, SD 57301; (605) 996-6895



Boomerans Raceway, 105 N. Main, Hartford, SD 57033; Ed Smithback, (605) 528-7345



Dakota Off-Road Racers, 2989 W. Br. Co. 12, Aberdeen, SD 57401; (605) 226-0604



Goldtrax Raceway, 409 E. High, Lead, SD 57754; Steve Brown, (605) 584-2355

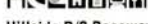


K&B Speedway, 27283 SD Hwy. #115, Harrisburg, SD 57032; Mike Kosetin, (605) 743-2582



TENNESSEE

D&M's Downtown Raceway, 2703 U.S. Hwy. 411S, Maryville, TN 37303; (423) 681-8919



Hillside R/C Raceway, 4194 Oakhill Rd., Dayton, TN 37321; John and Rusty Tipton, (423) 775-4739



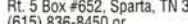
Lawson Raceway, 152 Joel Rd., Oliver Springs, TN 37840; Anthony Lawson, (206) 815-0379



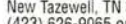
Machine-Head Straits, 938 Grandmere Rd., Lawrenceburg, TN 38464; Larry and Eliane Sanders, (615) 762-6630



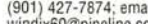
MSA R/C Racing, Rt. 12 Box 489 B, Crossville, TN 38555; D.R. Findley, (615) 456-0027



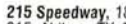
Sparta Raceway Park, 32 N. Main St., Sparta, TN 38583; Carl (Buddy) Elrod, Rt. 5 Box #652, Sparta, TN 38583; (615) 836-8450 or (615) 761-3407



TnT Raceway, 643 Loop Hollow Rd., New Tazewell, TN 37825; Cliff Swett, (423) 626-9065 or (423) 869-8942



W.O.W. Raceway, 59 Luray Rd., Beech Bluff, TN 38313; Kelly Bean, (901) 427-7874; email: windix60@pipeline.com



TEXAS

215 Speedway, 1814 County Road 215, Abilene, TX 79602; Clyde Gardner, (915) 673-2351



Big Mike's R/C Raceway, 1405 W. Cotton St. (behind the Locker Room), Longview, TX 75604; (903) 297-7814



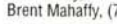
Comanche Trail RC Park, City Park, Big Spring, TX 79720; Allen Nichols, (915) 263-4241



Command Hobbies, 6929 Airport Ste. 146, Austin, TX 78752; Tony Bermudez, (512) 458-2324



Drycreek Raceway, 5903 Co. Road 2297, Quinlan, TX 75474; Micky Alphin, (903) 883-4060



Eastex Raceway, 45000 Hwy. 59 N., New Caney, TX 77357; Brent Mahaffy, (713) 399-9777



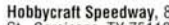
Fastrack Raceway, 301 Edith Drive, El Paso, TX 79924; Hector Gonzalez, fax (915) 779-4524



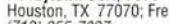
Flip & Spin R/C, 5957 Jones Rd., Bryan, TX 77807; Garland Crabb, (409) 822-7311



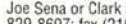
Hal's Hobby Raceway, 1440 Bessemer, El Paso, TX 79936; (915) 591-2213



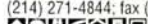
The Hobby Center Raceway, 4104 Stan Schluter Loop, Ste. 1, Killeen, TX 76543; Lawrence Remick, (817) 690-7311



Hobbycraft Speedway, 819 N. Main St., Corsicana, TX 75110; Keith Hoffman, (903) 872-6761



Hobbytown USA, 7676 FM 1960 W., Houston, TX 77070; Fred Pfafman, (713) 955-7097



Hobbytown USA, 999 E. Basse Rd., Suite 177, San Antonio, TX 78209; Joe Sena or Clark Baisdon, (210) 829-8697; fax (210) 829-8707



Keyser's Hobbies, 1643 Texas, College Station, TX 77840; Bill Bennett, (409) 693-8095



MBRC Off-Road Raceway, 204 D&E Valley Lane, Kennedale, TX 76133; (817) 292-5055



North Houston Speedway, 11847 Spears Rd., Houston, TX 77067; Bob or Carol Hillin, (713) 872-2471



North Texas 1/2 Scale Association, 3905 Sandia, Plano, TX 75023; Dean Densmore, (972) 519-0324



Performance Raceway, 1106C Witte Rd., Houston, TX 77055; Jorge Tabush or Terry Schmid, (713) 464-4458



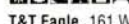
Rev It Up Raceway, 3076 Keller Rd., Smithville, TX 78957; Rev. Alton T. Edwards, (512) 360-5443



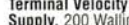
Rick's R/C Raceway, 23B Scenic Loop, Boerne, TX 78000; Rick, (210) 981-2245 or Rich, (210) 590-1805



Rough Country, 905 Jacksboro Hwy., Wichita Falls, TX 76301-5310; Robert Kerr, (817) 322-2453



Star/Car Raceway, 5802 Patton St., Corpus Christi, TX 78415; Glen Stead, (512) 949-8525; Race Hotline, (512) 881-6105



T&T Eagle, 161 W. Spring Creek Pkwy., #601, Plano, TX 75023; Tony Welborn, (214) 517-0562



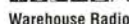
Terminal Velocity R/C Raceway & Supply, 200 Wallington, Ste. 223, El Paso, TX 79902; Rick or Frank, (915) 534-9198



Texas Speedway, 6707 Chimney Rock, Bellaire, TX 77401



Tiger's Den R/C Speedway, 702 E. Broad St., Mansfield (DFW), TX 76063; Bob Burns, (817) 477-5513



T.O. Offroad Raceway, 6236 Quail, El Paso, TX 79924; Eren Saenz, (915) 821-7522



Triple Jay R/C Raceway, Rte. 4, Box 720, Allen, TX 75002; Jeffrey Jay Johnson, (972) 562-7967



Warehouse Radio Controlled Raceway, 612 W 4th St., Amarillo, TX 79101; Craig or Darren Waddell, (806) 374-6485



W.E.S. Hobby Race, 980 S. Fourth St., Beaumont, TX 77701; Edmond Richards, (409) 839-4929

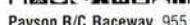


Wild Bill's Raceway, 535 E. Shady Grove, Irving, TX 75060; Lynn Morgan or Tom Nix, (214) 438-9224

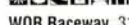


UTAH

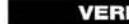
Intermountain R/C Raceway, 8481 W. 2700 S., Magna, UT 84044; David Mott, (801) 250-8303



Payson R/C Raceway, 955 South Main, Payson, UT 84651; Gus Wood, (801) 224-3852 and Lasca Wood (801) 222-8677



WOR Raceway, 3170 Brinker Ave., Ogden, UT 84401; Brian Worton, (801) 393-2530



VERMONT

Barre Town R/C Club, 14 South Main St., Wall St. Complex, Barre, VT 05641; Russ Tribble or Pete Perreault, (802) 888-2860 or (802) 476-9458



Bradford R/C Racing, Main St., Bradford, VT 05033; Seth Bean, (802) 222-9674



Stoughton Pond Raceway, Stoughton Pond Rd., Perkinsville, VT 05151; Rick Adams, (802) 263-9321



VIRGINIA

Bob's Hobbies & Raceway, 7422 Brandy Creek Dr., Mechanicsville, VA 23111; Bob, (804) 746-2758

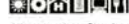
Brown Brothers Hobbies, 924 North Main Street, Dumfries, VA 22026; Joel or Bob Brown, (703) 221-5746



Cooper's R/C Race Center, 4000 Sago Rd. (969), Chatham, VA 24531; Norris Cooper, (804) 724-7342 or (804) 724-4182



DCRW Raceway, Debbie's RC World, 2200 Commerce Parkway, Virginia Beach, VA 23454; Les Modlin, (757) 340-6681



Gloucester Scale Hobbies, 2352 George Washington Memorial Highway, Hayes Plaza, Hayes, VA 23072; Rob Thein, (804) 642-3484



Hobby Hangers Speedway, 14014 D Sullyfield Cir., Chantilly, VA 20151; Kwang or Billy, (703) 631-8820



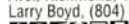
The Hobby House, 116 Edds Ln., Sterling, VA 20165; Opole, (703) 444-0333



KC's Radio Control & Repair, Rt. 4, Box 312, Trents Ferry Rd., Lynchburg, VA 24503; Curtis or Kim Wright, (804) 384-8596



Olde Towne Hobby Shoppe, 9105 Center St., Manassas, VA 22110; Arnie Levine, (703) 369-1197



Race World Hobbies, 6102 Lakeside Ave., Richmond, VA 23228; Larry Boyd, (804) 553-8040



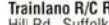
Roadmasters/Rick's Hobbies, 12201 Balls Ford Ave., Manassas, VA 22110; Rick, (703) 330-6833



Shamrock Raceway, P.O. Box 3739, Winchester, VA 22601; Kevin Allen, (540) 662-0403



Thunder Road RC Racing, P.O. Box 1022, Troy, VA 22974-1022; James Palmer, (804) 589-8174



Trackside Hobbies, 1920 E. Pembroke Ave., Hampton, VA 23663; Rick Cardwell, (757) 723-4170



Trainlano R/C Racing, 5661 Shoulders Hill Rd., Suffolk, VA 23435; Frank Stevens, (757) 488-5454



WASHINGTON

Alfie's, 108 South K St., Aberdeen, WA 98520; (360) 533-6638



A-Main Raceway, 14011 NE 3rd Ct., Vancouver, WA 98685; Monty Coleman, (360) 571-8404



Burien Toyota R/C, 15025 1st Ave., South, Seattle, WA 98148; Ray Meek, (800) 654-6456



C&C Raceway, 266 Lind Ave. NW, Revton, WA 98055; Charles Lakin, (206) 227-5167



Four Season R/C Racing, 2941 Sleater Kinney Rd. NE, Olympia, WA 98506; Gary and Sharon Brown, (360) 491-2430

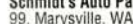


Hale's R/C Raceway Park, 10611 136th St. E. Puyallup, WA 98374; Walt Hale, (206) 845-7675

Hannegan Speedway, 4212 Hannegan Rd., Bellingham, WA 98225; Dana Hoggarth, (360) 734-4090



Raceway Hobbies, 188 Sunset Ave. S., Edmonds, WA 98020; Brian Bodine, (425) 774-3285



Schmidt's Auto Parts, 10305 Old Hwy. 99, Marysville, WA 98271; Jon Faila, (206) 653-8838



Spokane Indoor Raceway, 6422 E. 2nd Ave., Spokane, WA 99212; Dave Mapston, (509) 534-RACE



Tacoma R/C Raceway, 6305 6th Ave., Tacoma, WA 98406; Scott Brown, (206) 565-1935



Tearor Raceway, Fantasy World Toy and Hobby, 7901 S. Hosmer, Tacoma, WA 98408; Dave Kleinman, (206) 473-6223



Ultimate R/C Raceway, 907 Cole St. #3, Enumclaw, WA 98022; Dan Daugherty, (360) 802-2388



Zep's Hobbies & Race


Xtreme Hobbies Raceway, 2724 Powder Basin, Gillette, WY 82718; Krieg Balls, (307) 682-6077


ARGENTINA

Club A. Velez Sarsfield, Av. J.B. Justo 9000, C.P. 1408, Buenos Aires; Jorge Herrero, 54-01-658-5851


AUSTRALIA

A.C.T. Model Car Racing Club, offroad track—Wanniassa Raceway, Hyland Place—Wanniassa A.C.T.; indoor track—Epic Complex, Northbourne Ave., Canberra North A.C.T.; Gary Davey, 61-6-2871411


Aubry R/C Car Club, Aubry Showgrounds, Aubry, NSW 2640; Ron Langman, 060-247-128


Canberra Off-Road Model Car Club, Goyder St., Narrabundah, ACT 2604; Graham Brown, 61-6-241-3070


Central Coast ORRC, EDSACC Sports Complex, Bateau Bay, N.S.W. Australia 2261; Peter J. Knight, 61-43-693-698


Fast n' Fun, 250 Potreath Rd., Bellbrae West, Torquay, VIC 3228 Australia; Stephen Chara (613) 5266 1550 or (613) 5266 1556; fax (613) 5266 1556


Illawarra RCECC, Croome Sporting Complex, Albion Park Rail, NSW 2527; Mel or Andrew, 042-714-683


Lakeside R/C Racing Car Club, Hollywood Rd., Lansvale, NSW 2166; R. Bartolozzi, 62-2-907-9800


Melton Electric Circuit Car Association, Safeway Car Parkm Corner High St. and Coburns Rd., Melton, VIC 3337; Arthur Joslin, 61-3-9747-8805


Northern Districts Model Rally Club, Inc., Rear Stanford Centre, 16 Stanford Way, Malaga, Western Australia 6066; G. Thirlwell, 61 (9) 249 3855; fax 61 (9) 249 4778; email tony@ois.com.au


Penfield Park, DSTO Complex Salisbury, Adelaide, South Australia 5108; Trevor Unsworth, (618) 8289-5010


Templestowe Flat Track Racers, Templestowe Reserve, Corner of Porter St. and Williams Rd., Templestowe, Melbourne, Victoria 31066; Renato Benci, 61 (3) 9553 4625


Wodonga R/C Car Club, 11 Murphy St., Wodonga, VIC 3690; Ron Langman, 61-60-247-128


BELGIUM

ATR-Alka-Tele-Racing, 3570 Stationstraat 21, Alken Limburg; 0032-11-25-49-03


Cartroubles Indoor Buggy Track, Jan Moonsstraat 52-56, 2160 Wommelgem, Belgium; Guy Ermes, 32-3-326-51-15; fax 32-3-326-51-01


MBV-Kampenhout, Teniersin 28, Kampenhout B1910, Belgium; Frank Mostrey, phone and fax 0-16-65-75-18


MRCZ, Centrum, De Burg, Belgium; Montie, 75-71-63


Model Racing Club Oudenaarde, Scheldekant, 9700 Oudenaarde, Belgium; A. Chanterie, 32-55-31-36-48; fax 32-55-30-19-12


R.C.R., Peilstraat 43, Retie 2470, Belgium; A. Eelen, phone and fax 32-14-373685



BRAZIL

Amoc Cassociacao de Modelismo B. Camborio, Junto ao Par Que Ecologico de Bal. Camborio, Bal. Camborio, S.C. 88.330-000; Leo Cesar, (047) 366-0001


Brasilia R/C Motor Circuit, Estacionamento do Estadio Mane Guarrincha, Brasilia, DF 70000, Brazil; Alexandre (Alex), 55-061-273-7205


Hobby Center, SQS.210 B.I.H. Apt. 204, Brasilia, DF-Brasil 70.273; 061-242-0488


Hobby Planet Racing Club, Rod Dom Pedro 1, KM 1315, Campinas, Sao Paulo, Brasil 13091901; Daniel, Helio, Luciano, 019 258 2768


Jungle Drive, Rua Alberto Maranhao, No. 219 Icha do Gov. Rio de Janeiro, 21940-490; Paulo Brito (021) 396-0851 or (021) 393-7449


MP Raceway, AV. Nacoes Unidas, 6815 Lapa, Sao Paulo; Gard Heitrotter, 55-11-9819039; www.hpraceway.com.br


Off Roaders, Av. Guillerme Dummont Villars, 317, Sao Paulo, CEP 05640; Waldir Ielpo, (055) 011-260-5628; fax (055) 011-831-4931


Way of R/C Off-Road Cerrado, Rua Paraiba 1323, 1st floor, Belo Horizonte, Minas Gerais; Claudio T. Correa, (031) 227-6111, fax (031) 227-6869


CANADA

Action Weelz, 462 Turcotte, Vanier, Quebec, G1M 1R6; Regent Tardif, (418) 527-5756



Advance R/C Raceway, 4181 Sheppard Ave. E. Scarborough, Ontario M1S 1T3; Albert Lau, (446) 321-8377


A&J Toronto R/C Raceway, 24 Main St., Building B, Unionville, Ontario L3R 2E4; (905) 305-1479



The All New R.C. World, 2633 Hwy. #6, Mt. Hope, Hamilton, Ontario L0R 1W0; Dave, (905) 765-2301, Larry, (905) 333-3297 or Brian, (519) 752-0044


ATN, Auto Teleguide Nicolet, 2000 Rue Paul Hubert, Saint-Jean-Baptiste-de-Nicolet, Quebec J3T 1E5; Louis Durand, (819) 293-6097



Auto Sprint, 6065 Des Grands Prairies, St. Leonard, Quebec H3G 2R6; David Kalayjian, (514) 287-3503


Circuit J.C., 1283 Chemin, St. Philippe, St Polycarpe, Quebec J0P 1X0; Jean Castillon, (514) 267-7854


Circuit Pepsi, Centre de Location, 37 duRoi, Sorel, Quebec; (514) 746-8828


Circuit Plessis, 260 Rang 9 Ouest, Plessisville, Quebec G6L-2Y2; (819) 362-3743



Circuit R/C Pro, 1500 Chemin Sullivan, Val d'Or, Quebec; J9P 1M1; R/C Modeler Plus, (819) 874-3918


Circuit Teleguide St. Roch, 363-B St. Charles, St. Roch De L'achigan, Quebec J0K 3H0; (514) 588-4254, fax (514) 588-6554


Circuit Teleguide Grand Prix, 9600 Ignace, Ste. C, brossard, Quebec J4Y 2R4; (514) 444-1286


Club Avatt, 244Jules-Richard, Deauville, Quebec J1N 3; Daniel Vanier, (819) 864-6262


Club RC51, 44 Rue Holliday, Sept-Iles, Quebec G4R; Sylvio Gerard, (418) 968-6575; Hobby Shop, (418) 962-6565


CRCCC, Box 309, Clinton, Ontario NOM 1L0; Eric Russell, (519) 482-9429


CTG, 450 Chemin de la Grand Ligne, Granby, Quebec; (514) 358-4419


CTL, 495 Industriel, Longueuil, Quebec; (514) 358-4419

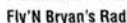

Dustkickers R/C Raceway, 1785 Cypress Rd., Quesnel, British Columbia V2J 4B1; Darrell Dinsdale, (250) 747-2680



Dynamic Hobbies, 21 Concourse Gate, Unit 6, Nepean, Ontario, K2E7S4; Clark Freeman, (613) 225-9634


East Coast Model Center Raceway, 13 Glen Stewart Dr., Ste 1, Southport, Prince Edward Island C1A 8X9; Gary Stephen, (902) 569-3262


Evolution Speedway, 1935 Glengrove Rd., Pickering, Ontario L1V 1X3; Eric Lang, (905) 839-2084


Fast-Trax Speedway, RR 4, Trenton, Ontario; Russ McPeak, (613) 394-6411


Fly'n Bryan's Radical Raceway & Little Shop of Hobbies, RR #1, Ste. 12, Comp. 49, Chase, British Columbia, Canada V0E 1M0; Bryan Coffey/ Dani Potvin, (604) 955-0669


Honda House Motor Speedway, 384 Richmond St., Chatham, Ontario N7M 1P9; John Elliot, (519) 354-5530


Interior R/C Raceway, 34-1605 Summit Dr., Kamloops, BC, V2E 2A5; Martin Vannieuwenhuizen, (604) 374-1268 or (604) 374-8458


J-T International Raceway, 127 Milligan Lane, Nanapanee, Ontario K7R 8A1; N. O'Neill, (613) 354-0099


Leading Edge R/C Speedway, 731 Gardiners Rd., Kingston, Ontario K7M 3Y5, Canada; Mike and Tony Daicar, (613) 389-4878


Mid-Canada R/C Speedway, 1678 St. James St., Winnipeg, Manitoba R3H 0L3; Richard Driedger, (204) 339-6566


Minatures & Passions, 204 St. Charles, #103, Ste. Therese, Quebec, Canada J7E 2 B4; Gilles Lachance, (514) 979-7989


MORRAC Raceway, 6449 Crowchild Tr. SW., Box 36060, Calgary, Alberta T3E 7C8; (403) 254-1386


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

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CHRIS'S back lot

BY CHRIS CHIANELLI

Chris's Top Ten

OK, here's the most important stuff in the whole entire magazine. My picks—MINE!!!

Associated T-3

stadium truck



O.S.'s

revolutionary 12 LD



Eric Clapton

Keyence

1/18-scale, R/C tractor trailer



OFNA
Nitro F-1



Luna



Kyosho
Landmax 1/8-scale rally cars

32-valve,
4-liter, V-8

Shelby Series 1



Joan Chen

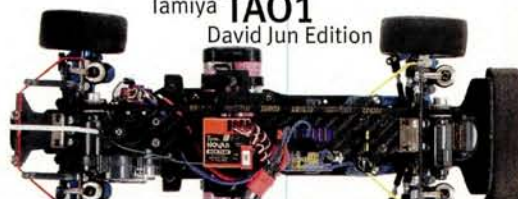
best choice to play Ng Mui (pronounced "eng mew"), a nun and sole survivor of the Shih Lim Temple grand masters who developed an awe-some form of kung fu 250 years ago. Ng Mui passed on this secret martial art to a female orphan. She named the child and the new martial art "wing chun."



in the lame-stream: Spice Girls



Tamiya TAO1 David Jun Edition



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Slix Decals, 13075 Springdale St., Ste. 456, Westminster, CA 92683; (714) 891-4212.

Tamiya America Inc., 2 Orion, Aliso Viejo, CA 92656-4200; (800) TAMIYA-A; fax (714) 362-2250; website: www.tamiya.com.

Team Losi, 13848 Magnolia Ave., Chino, CA 91710; (909) 465-9400; fax (909) 590-1496.

Team Orion, distributed by Peak Performance (see address above).

Traxxas Corp., 12150 Shiloh Rd., #120, Dallas, TX 75228; (972) 613-3300; fax (972) 613-3599.

Trinity Products Inc., 36 Meridian Rd., Edison, NJ 08820; (732) 635-1600; fax (732) 635-1640; email: information@teamtrinity.com; website: www.teamtrinity.com.

Xipp Mfg.; 4201 Church Rd., Ste. 265, Mt. Laurel, NJ 08054; (609) 778-9477.

Yokomo USA, Airport Business Center, 17951 Skypark Cir., Ste. K, Irvine, CA 92614; (714) 252-8663; fax (714) 252-8657.